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AIR FORCE FLIGHT TEST CENTER TEST PLAN PREPARATION GUIDE

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TECHNICAL INFORMATION HANDBOOK

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AIR FORCE FLIGHT TEST CENTER
EDWARDS AIR FORCE BASE, CALIFORNIA
AIR FORCE MATERIEL COMMAND
UNITED STATES AIR FORCE

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ROGER C. CRANE
Senior Technical Advisor
412th Test Wing

GARALD K. ROBINSON
Colonel, USAF
Commander, 412th Test Wing

RICHARD V. REYNOLDS
Brigadier General, USAF
Commander, AFFTC

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The Air Force Flight Test Center (AFFTC) Test Plan Preparation Guide provides the established guidelines to assist test plan authors in preparing accurate and clearly written AFFTC test plans. The objectives of this handbook are to: provide background information that assists a test planner with the test planning process; serve as a checklist for generally applicable test plan requirements; provide a standard, generalized format that is easily tailored to specific program needs; and to facilitate the development of completed test plans that readily carryover into AFFTC test reporting. The AFFTC test plan, resulting from using this guide, is a document containing all the information necessary for testing. The purpose of this guide is to provide guidelines for test plan preparation by anticipating and answering questions most frequently asked by authors regarding content, format, and style.

The format of this guide allows the test plan author the flexibility to more efficiently tailor the test plan to various test scopes (in terms of size) as well as to particular types of systems. It is written with avionics test plans in mind, but can be adapted to test plans of any discipline.

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PREFACE

This handbook provides the established guidelines to assist test plan authors in preparing accurate and clearly written test plans. The Air Force Flight Test Center Test Plan Preparation Guide format allows the test plan author the flexibility to more efficiently tailor the test plan to various test scopes (in terms of size) as well as to particular types of systems. It is written with avionics test plans in mind but can be adapted to test plans of any discipline.

The objectives of this handbook are to:

1. Provide background information that assists a test planner with the test planning process.

2. Provide a checklist for generally applicable test plan requirements.

3. Provide a standard, generalized format that is easily tailored to specific test program needs.

4. Facilitate the transfer of text from the test plan into the final test report.

The January 1999 revision is a product of various contributors from the 412 Test Wing and the Computer Sciences Corporation technical editors.

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EXECUTIVE SUMMARY

The Air Force Flight Test Center Test Plan Preparation Guide provides established guidelines to assist test plan authors in preparing technically accurate and clearly written test plans. The guide format allows the test plan author the flexibility to tailor the test plan for various reasons such as project size and type of system under test.

This document, although intended as a guide for preparing detailed test plans, is applicable to both Integrated Test Plans and Detailed Test Plans, as defined by AFI 99-101, *Developmental Test and Evaluation* (Reference 1).

The primary goal of any test project is to evaluate selected aspects of system performance for a customer such as a Major Command, System Program Office, or other Government agency. The customer requires these evaluations to support decisions concerning system development, acquisition, and operational use. The end product of a test project is a technical report that is provided to the customer to support the decision making process.

The objectives of this handbook are to:

1. Provide background information which assists a test planner with the test planning process.

2. Provide a checklist for generally applicable test plan requirements.

3. Provide a standard, generalized format that is easily tailored to specific test program needs.

4. Facilitate the transfer of text from the test plan into the final test report.

The Test Plan Preparation Guide is organized into six sections; Introduction, Elements of the Test Plan, References, Bibliography, Master List of Abbreviations, Acronyms, and Symbols, and an Index. There are 14 appendices. Appendix A details the requirements for marking the various elements of a classified test plan. Appendix B describes how to plan, write, revise, get approval, and prepare the test plan. Appendix C is a checklist to ensure that key information is not left out of the test plan. Appendix D is a checklist to ensure environmental issues have been addressed. Appendices E through N provide references with specific guidance for various test disciplines. A Sample Test Plan is provided so the reader can see how all the elements fit together.

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INTRODUCTION

GENERAL

The purpose of this document is to provide guidelines for preparing detailed test plans by anticipating and answering the questions most frequently asked by authors regarding content, format, and style. The format allows the test plan author the flexibility to more efficiently tailor the test plan to various test scopes (in terms of size) as well as to particular types of systems. This document, although intended as a guide for preparing detailed test plans, is applicable to both Integrated Test Plans (formerly System Test Plan) and Detailed Test Plans, as defined by AFI 99-101, *Developmental Test and Evaluation* (Reference 1).

The primary goal of any test project is to evaluate selected aspects of system performance for a customer such as a Major Command, System Program Office, or other Government agency. The customer requires these evaluations to support decisions concerning system development, acquisition, and operational use. The end product of a test project is some form of technical report that is provided to the customer to support the decision making process.

See Air Force Flight Test Center Instruction (AFFTCI) 99-1, *Test Plans* (Reference 2), and AFFTCI 91-5, *Test and Safety Review Process* (Reference 3), for the details of the test plan review and approval process.

USE OF THE TEST PLAN PREPARATION GUIDE

This handbook is organized into 6 sections; Introduction, Elements of the Test Plan, References, Bibliography, Master List of Abbreviations, Acronyms, and Symbols, and an Index; 14 appendices; Appendix A - Classification Requirements for Test Plans, Appendix B - Procedures, Appendix C - Test Plan Checklist, Appendix D - Environmental Checklist, a set of ‘open ended’ appendices (Appendices E through N) for specific guidance for various test disciplines to be added at a later date when and if appropriate; and 1 attachment: a Sample Test Plan (Attachment 1). The Introduction section provides an overview of the Government acquisition and development process, test process elements, and key requirements for successful testing. The Elements of the Test Plan section describes each test plan element in detail including which elements should be transferred, for the most part, to the final test report. The References section contains technical writing references and pertinent regulations. The Bibliography section provides useful test-related handbooks. The Master List of Abbreviations, Acronyms, and Symbols contains the abbreviations used throughout the handbook and most abbreviations used at the Air Force Flight Test Center. It also lists common abbreviations that do not have to be defined when first used. The Index section eases the search for desired information in the handbook. Appendix A details the requirements for marking the various elements of a classified test plan. Appendix B describes how to plan, write, revise, get approval, and prepare the test plan. Appendix C is a checklist to ensure that key information is not left out of the test plan. Appendix D is a checklist to ensure environmental issues have been addressed. Appendices E through N provide references for various test disciplines. A Sample Test Plan is provided so the reader can see how all the elements fit together to provide the link from the customer requirements to measurable system performance parameters, to how and when the parameters are measured, to final data analysis and data product production.

BACKGROUND

Government military acquisition and development programs are usually based on a top-down process designed to ensure that final products meet customer needs. The process begins with an approved operational need followed by the application of various analytical methods to determine initial system performance and design goals. The analytical methods used, such as modeling and simulation, are based on estimates and statistics. As a result, analytical methods alone cannot adequately characterize system performance. Developmental testing is required to reduce technical risk and to ensure that performance and design goals are being met.

The developmental test process is used to efficiently measure system performance parameters to determine if performance and design goals are being met. Developmental test and evaluation (DT&E) programs provide an initial assessment of military utility and effectiveness by measuring system performance against performance and design goals. Each of the elements shown in Figure 1 are required for a successful test and evaluation program but the type of test being conducted can have a significant effect on how the test elements are applied. For example, the reportable issue for the demonstration/validation test of an experimental radar system may be to show a capability to track more than three targets simultaneously. During full scale engineering development of the same radar system, a reportable issue may be to measure tracking accuracy while the radar tracks three targets simultaneously.

* Determine Reportable Issues (Critical Questions)
    - Define Test Report Elements
* Define Specific Test Objectives
    - Relate Performance and Design Goals to Reportable Issues
* Establish Associated:
    - Measures of Performance
    - Evaluation and Success Criteria
    - Data Requirements
    - Test Resource Requirements
* Prepare a Test Plan to Include:
    - Data Analysis and Logistics Support Plans
    - Instrumentation Plan
    - Parameters List
    - Test Matrix and Schedule
* Conduct Test
* Produce Data Products, Analyze Data, and Evaluate Results
* Produce and Publish Final Technical Report

Figure 1 Test Process Elements

Some of the common terms used within the acquisition community have different meanings depending on how the term is used. Acquisition terms are defined in many official documents but one source of information for the test planner is the *Defense Acquisition Deskbook* (Reference 4). The deskbook identifies acquisition management core processes, the associated terms, and includes many DoD and Air Force documents for reference. The list of terms below were selected because they are important to test planners. All of the definitions came from official documents.

1. **Measure of Effectiveness (MOE):** A qualitative or quantitative measure of a system's performance or a characteristic that indicates the degree to which it performs the task or meets a requirement under specified conditions. Where possible, MOEs should be defined to measure operational capabilities in terms of engagement or battle outcomes.

2. **Critical Operational Issue (COI):** A key question that must be examined in operational test and evaluation to determine the system's capability to perform its mission. Testers normally phrase a COI as a question to be answered in evaluating a system's operational effectiveness or suitability.

3. **Measures of Performance (MOPs):** A quantitative measure of the lowest level of physical performance (e.g., range, velocity, payload).

4. **Participating Test Organization (PTO):** A test organization required to afford specific resources during DT&E.

5. **Requirement:** The validated need of an operational user. Initially expressed in broad operational capability terms in the format of a mission need statement (MNS). It progressively evolves to system-specific performance requirements in the operational requirements document (ORD).

6. **Responsible Test Organization (RTO):** The lead Government entity that is qualified and responsible for DT&E.

7. **Test Information Sheet (TIS):** (From AFFTCI 99-1 [Reference 2]) Also known as a detailed test plan (DTP), a TIS will be used to define and amplify specific tests identified in a system test plan and will either stand alone or be part of an overall plan that is general in nature. For AFFTC TISs, an AFFTC Form 5232b, AFFTC Test Information Sheet (with signature blocks), will be used as the cover sheet for stand-alone plans and AFFTC Form 5232a, AFFTC Test Information Sheet, for TISs that are included in overall plans. The AFFTC Form 5232b will also be used as a cover sheet for contractor-prepared DTPs.

8. **Test Objective:** The specific performance or technical parameters to be measured during the test to evaluate system performance, system operational effectiveness, or system suitability.

9. **Test Requirements:** Test requirements are formulated from, but not limited to: MNS, ORD, system specification(s), previous test results, Test and Evaluation Master Plan (TEMP), overall objective and general test objectives, Single Face to the Customer (SFTC) inputs, and previous test experience.

INTEGRATED TEST PLAN VERSUS DETAILED TEST PLAN

The integrated test plan (ITP) is a program management tool that ensures all appropriate test activity is included, duplicative testing is not being done, risks are identified, and all participants understand the total test effort. The ITP is sometimes referred to as a system test plan.

The ITP is written early in the program’s schedule and changes as more detailed planning is accomplished. The ITP is normally written by the program office with a lot of help from the RTO, PTOs, and support groups. Since the ITP is written early in the program’s schedule, prior to the accomplishment of the detailed planning for each test, some sections will necessarily be general in nature. However, all sections should specify the general approach that will be followed in the test effort. The DTPs will contain all the detailed information that the ITP could not contain.

Per AFI 99-101 (Reference 1), the ITP:

1. Describes the total test management effort,
2. Describes the most efficient use of all test resources, and
3. Records all DTPs for all project participants (contractors and government).

An ITP may or may not be required depending on the scope of the test program but all test programs must be documented in a DTP. The DTP(s) contain(s) all the information necessary for the test team to conduct the actual tests. The DTPs go by a variety of names depending on what organization wrote the plan. Most common names are: test information sheet (TIS), detailed test information sheet (DTIS), and flight test work order (FTWO). Most DTPs also have a particular cover sheet unique to the organization that contains basic administrative information such as authors names, proposed test dates, RTO, financial identification numbers, type of aircraft, etc.

A DTP brings together common tests, objectives, and/or measures of performance (MOP) that can be accomplished during a single test condition, test flight, or some subset of a test project. It is used at the working level on a daily basis for such things as writing tests cards, briefing missions, and ensuring all test resources are in place on the actual day of the test. The DTPs are the key documents that describe each unique test setup and the detailed, step-by-step, test procedures. The DTP should contain sufficient information for use by a test engineer to develop test cards and for management to discern the overall technical approach being taken. How detailed each DTP section is depends on the complexity of the system, and the complexity of the tests. The level of detail depends on what the **test team and senior managers** need to safely accomplish the test. For example a tower-fly-by airspeed calibration on a T-38 aircraft requires relatively little detail since it is a simple test, on a well-known aircraft, using a well-known test method. On the other hand an engine water-ingestion test on a one-of-a-kind prototype aircraft with a new engine will require relatively more detail. The DTPs are also used to track test point completion. The DTP is usually prepared by the test engineer and used by the mission planner and test conductor.

All test plans are management tools. As such, they should be tailored to the specific program. For example: major DT&E programs like the C-17 or B-2 will have a large ITP and numerous DTPs. For major DT&E programs, putting all the detailed information that is in the DTPs into the ITP would create an encyclopedic document that would be unwieldy to use. Therefore, the ITP sets out all the general philosophies and approaches; the DTPs, of which there may be several hundred, set out all the details for each test point. The DTPs may be attached to the ITP as appendices. At the other extreme, a one flight program to confirm the structural integrity of a new, small radome on a RC-135 aircraft will not have an ITP; however, it will have a single DTP. The difference between the two extremes is in the level of detail and volume of the documents. Each program should decide for itself what combination of test plans provides the best management tools for its purposes. However, all projects will use a DTP as the primary test plan document for the day-to-day planning, setup, and conduct of the test project.

This guide and the sample test plan (Attachment 1) suggests the same format for both the ITP and DTPs. The difference between the two will be in the level of detail contained in any section. Parallel formats will make it easy for the test team to correlate the two documents.

KEY CONCEPTS FOR SUCCESSFUL TESTING

There are several important concepts that can help lead to a successful test and all are equally important. They are the following:

1. **Early Involvement of Test Personnel**: Test engineers, including all test support disciplines, should become involved in the system development program during the earliest stages. Early involvement can save time, money, and resources. A test planning working group (TPWG) should be setup with members representing the program office, the user, the contractor, the RTO, PTOs, and AFOTEC. Having the first TPWG meeting during the contract proposal review is not too early. Early involvement is recommended to ensure that test-unique requirements can be addressed and long-lead test resources can be acquired.

Test unique requirements may include modifications to the system for test support. The cost to incorporate test-unique data ports and sensors during design is usually insignificant. Modifying systems after they are built is always more expensive and in some cases may be out of scope for the program. Users and contractors almost always, and rightly so, propose and design systems to satisfy operational requirements. Significant lead times may be required to provide test resources such as aircraft modifications, special instrumentation, and data reduction and analysis software. Early involvement of test engineers can help ensure that items such as digital data ports, strain gauges, temperature sensors, and so on are incorporated into the basic system design so testing will be economical, efficient, and productive.

2. **Test the System**: All system functions defined in the system performance and design goals should be accounted for equally in the test objectives and associated measures of performance. Those functions or subsystems which have already been successfully demonstrated should undergo some level of regression testing to verify that they still operate properly after the new hardware or software is integrated into the

system. During test design, the test engineer should perform a 'cold blooded' assessment of system performance and design goals while determining the primary test objectives without taking into account what has and has not been done before. Those functions dependent on advances in technology will, naturally, require more indepth testing than that required to verify functions which have been previously demonstrated.

3. **Test Engineer Knowledge**: The test engineer should understand the technical details of how and why the system really works. This understanding is essential so that the test engineer can correctly design the test and specify the system instrumentation requirements, such as digital data ports, strain gauges, temperature sensors, and so on. Planning and coordination with the customer and contractor(s) may be necessary to provide the time and resources to satisfy this requirement.

4. **Traceability**: The physical measurements made during a test must track directly to, and provide answers for, the customer's questions concerning system performance and design goals. Often this is the most difficult challenge the test engineer must face during the design of a test. The customer usually wants answers to questions that relate to operational utility or military worth. Operational utility and military worth are quantities that are elusive and difficult to measure directly. An example of a customer test goal might be, will the system under test out perform enemy systems? The test engineer must first determine what measurable parameters determine the performance of a system of the type under test, then test the system to quantify these performance parameters, and finally compare the test results to the accepted intelligence estimates for the enemy system parameters. Modeling may be required to relate physical measurements to operational utility or military worth.

5. **Early Report Definition**: The author should begin writing the test plan only after defining the elements of the technical report. Having a clear definition of what the end product will be helps the planner define the questions to be answered during the test, define the data acquisition effort, characterize the data analysis process, and enhance the probability of success. A good test plan, with clearly-stated and well-defined elements, will provide the foundation for the data acquisition and analysis required to generate the customer's technical report. In addition, some elements of the test plan and technical report, often referred to as boiler plate, are almost identical and should be written with the technical report in mind.

ELEMENTS OF THE TEST PLAN

Test plans are made up of three major components: Front Matter, Body of the Test Plan, and Backup Material. Each of these components contains certain elements. Elements can be added or deleted to more efficiently tailor the test plan to your specific test program scope (in terms of size) as well as your particular type of system. The following is the recommended order. Those elements with an asterisk (*) can be transferred, with minor changes, to the technical report. Examples of most elements can be found in the sample test plan.

FRONT MATTER

- Outside Front Cover (*)
- Inside Front Cover (*)
- Qualified Requesters Statement (*)
- Preface (*)
- Executive Summary (*)
- Table of Contents (required if the test plan contains more than eight pages)
- List of Illustrations (required if the test plan contains more than five figures)
- List of Tables (required if the test plan contains more than five tables)

BODY OF THE TEST PLAN

- 1.0 Introduction
  - 1.1 General (*)
  - 1.2 Background (*)
  - 1.3 Test Item Description (*)
  - 1.4 Overall Test Objective (*)
  - 1.5 Limitations
  - 1.6 Test Resources (*)
    - 1.6.1 Modeling and Simulation (*)
    - 1.6.2 Test Facilities (*)
    - 1.6.3 Frequency Authorization
    - 1.6.4 Test Aircraft (*)
    - 1.6.5 Support Vehicle (*)
    - 1.6.6 Test Range (*)
    - 1.6.7 Instrumentation Requirements (*)
    - 1.6.8 Test Support Facilities and Equipment (*)
  - 1.7 Safety Requirements
  - 1.8 Security Requirements
    - 1.8.1 General Security
    - 1.8.2 Operations Security
    - 1.8.3 Communications Security
    - 1.8.4 Competition Sensitivity
  - 1.9 Test Project Management
  - 1.10 Test Environment
  - 1.11 Environmental Impact Assessment
- 2.0 Test and Evaluation
  - 2.1 General (*)
  - 2.2 General Test Objectives (*)
  - 2.3 Specific Test Objectives (*)
    - 2.3.1 Test Objective 1 (*)
      - 2.3.1.1 Measure of Performance 1 (*)
        - 2.3.1.1.1 Success Criteria

2.3.1.1.2 Evaluation Criteria
2.3.1.1.3 Exceptional Case to MOP
2.3.1.1.4 Evaluation Terminology
2.3.1.1.5 Final Data Products
2.3.1.1.6 Data Requirements
2.3.1.1.7 Algorithms Processes
2.3.1.1.8 Test Methodology (*)
2.3.1.1.9 Expected Test Results
3.0 Test Procedures
3.1 Pretest Briefing/Test Readiness Review
3.2 Test Execution
3.3 Post-Test Briefing
4.0 Test Reporting
4.1 Deficiency Report
4.2 Progress Report
4.3 Test and Evaluation Results Sheet
4.4 Preliminary Report of Results
4.5 Technical Letter Report
4.6 Technical Report
5.0 Logistics
5.1 General

BACKUP MATERIAL

References
Appendices
Test Condition Matrix
Requirements Traceability
Parameter List
Data Analysis Plan
Instrumentation Plan
Logistics Support Plan
List of Abbreviations, Acronyms, and Symbols (*)
Distribution List (*)

FRONT MATTER

OUTSIDE FRONT COVER

The outside front cover is the interface between the test plan and the reader. The test plan is an official U.S. Government publication and should reflect the professionalism of the AFFTC and the USAF. Cartoons or unofficial logos are inappropriate.

The outside front cover contains the following elements:

1. **Title**: The title should be brief and clearly describe the contents of the test plan. In most cases, fill in the program name. Use acronyms only if they are more commonly known or used.

2. **Names**: The author should be listed here, where applicable. No more than two names should be listed unless specific circumstances warrant it. Other contributors to the test plan should be acknowledged in the Preface.

3. **Test Plan Date**: The test plan date consists of the month and year in which the test plan received final review and approval by the Test Wing Commander.

4. **Distribution Statement**: Almost all test plans use Distribution Statement C (Test and Evaluation). The date of the Distribution Statement is the date the Controlling Authority approved the distribution list and the distribution statement. The Controlling Authority will vary, but is normally the System Program Office.

INSIDE FRONT COVER

The main purpose of the inside front cover is to document who wrote the test plan and who approved its publication and release. The list of authors should be limited to those individuals that wrote a significant portion of the test plan. Editorial comments do not constitute authorship. Usually, only one or two authors should be listed.

The following guidelines should be used when writing this test plan element:

1. Identify the originating office and its affiliation with the AFFTC.

2. The signature blocks required are those of the authors and the approval authorities. See AFFTCI 99-1 (Reference 2), and AFFTCI 91-5 (Reference 3), for the details of the test plan review and approval process.

3. Include program authorization(s) and date(s), e.g., program element code (PEC) and job order number (JON).

QUALIFIED REQUESTERS STATEMENT

This page is required in all test plans which are not cleared for public release. The qualified requester's page tells the reader where to obtain additional copies of the test plan and destruction instructions for the document. The format and wording for this statement is governed by DoD Regulation 5230.25-PH, *Control of Unclassified Technical Data with Military or Space Application* (Reference 5).

PREFACE

The Preface is where the author explains how this particular test plan fits into the overall test program, how it relates to previous test efforts, and its relationship to other test plans. The program authority should be recognized here; usually by stating the Program Management Directive number. It is also the section where the author can acknowledge the contributions of people other than the principal authors. The Preface should be very short and definitely not exceed one page.

EXECUTIVE SUMMARY

Because it is designed to be read by upper management, the Executive Summary is very important. The Executive Summary should be a stand-alone document. It may be the only section that executive-level personnel will read. It should be easy to read and relate only essential information. A narrative style is best, but should be brief and to the point. **THE EXECUTIVE SUMMARY SHOULD NOT EXCEED ONE PAGE.** This section is a summary of the test plan and will have condensed information from the Preface, Introduction, Test and Evaluation (T&E), Test Procedures, Test Reporting, and Logistics sections. Minimize the use of numbers and redefine units and acronyms. Individual paragraph headings are inappropriate. Discuss only the most important facts; these need not be in the same order or format as found in the T&E section. **DO NOT INTRODUCE ANY NEW MATERIAL**. Impact is a key concern in this section, so give the facts to the reader quickly and concisely. If the reader wants details, he must read on.

For an ITP the Executive Summary should very briefly address the following items, but in a narrative style with no titles or headings. For a DTP some of this material is on the front cover sheet and does not have to be repeated. For a DTP some of this information can be omitted. For example; the technical and safety reviews will necessarily have been conducted before the DTP is submitted for approval. Other documents in the 'safety package' cover the technical and safety review issues.

1. Overall Test Objective (one or two sentences)
    a. This section should state the overall objective of the test.
2. Background (one short paragraph)
    a. The document purpose (one statement).
    b. The project name.
    c. Who requested the test.
    d. The program authority - Program Management Number and precedence rating.
    e. Job order number.
    f. Time frame for testing.
    g. Number of tests.
    h. Test locations, facilities and other test participants.
3. Test Item Description (one paragraph)
    a. A description of the test article items **unique** to this test.
    b. Program history.
    c. State whether the test article is or is not production-representative for test purposes.
    d. Reference detailed test item documents.
4. Test Methodology
    a. State how the test(s) will be conducted.
    b. State the environment the test(s) will be conducted in.
    c. State how the data will be collected.

5. Technical Risk

    a. Address any items that may effect the executibility of the test plan.

6. Technical Review

    a. State what organizations you expect to participate.

    b. When will it take place?

7. Safety Review

    a. When will it take place?

    b. State whether the test itself or specific aspects of the test are expected to be low, medium, or high risk from a safety standpoint.

8. Environmental Impact Issues

    a. State if there are any expected environmental impacts.

    b. If an environmental impact study was prepared in the past, state whether an additional one is required.

    c. State the source and date of any environmental studies.

TABLE OF CONTENTS

The Table of Contents is a listing of the headings in the order in which they appear within the test plan. It is not required in test plans of less than eight pages. The order and headings must exactly match those appearing in the test plan. It is generally not necessary to list headings beyond the fourth order in the Table of Contents.

LIST OF ILLUSTRATIONS AND LIST OF TABLES

The List of Illustrations and List of Tables contains all the figures and tables, respectively, in the test plan by figure or table number, exact title, and page number. Titles should be descriptive, e.g., Angle of Arrival Summary, instead of AOA. The goal is to have a unique title for each figure or table and have it listed here exactly as it appears in the test plan. Unique titles may, in some cases, be hard to do. All test plans having more than five figures or tables must have a List of Illustrations or List of Tables, respectively.

The following guidelines should be used when writing this test plan element:

1. Ensure titles are identical to those in the test plan.

2. Use unique titles. Avoid duplicate titles except for groups of similar plots or tables.

BODY OF THE TEST PLAN

Here is where you define why and how you are going to do a test and what you expect to find out. You are attempting to explain complex issues, techniques, and procedures to a technically astute reader, not a layman. The reader will not be an expert in your engineering discipline, but will be reasonably versed in your weapon system. REMEMBER YOUR TEST PLAN IS NOT A NOVEL, SO DON'T COMPOSE IT LIKE ONE. Clarity is the goal. Keep sentence structure simple. Keep terminology as simple as possible and consistent with the technical aspects of your test. It never hurts to say the same thing a couple of different ways to be sure the point is made. Use terms standard within your discipline. Do not make up your own.

The body of the test plan contains all the elements which logically answer the following questions:

WHY is the test being conducted?
WHO will conduct the test?
WHO are the customers?
WHAT will be tested?
WHAT are the objectives of the test?
WHAT are the measures of performance (MOP) for each objective?
WHAT are the evaluation criteria for each MOP?
WHAT are the success criteria for each MOP?
WHAT final data products will be produced to answer each MOP?
WHAT tests will be conducted?
WHERE will the tests be conducted?
WHEN will the tests be conducted?
HOW will the tests be conducted?
WHAT data need to be acquired, reduced, and analyzed?
HOW will the data be acquired, reduced, and analyzed?
WHAT are the expected results of the tests?
WHAT test reporting will be accomplished?
WHAT logistics support is required for the test?

The following pages outline the common elements of the body of the test plan and the information that is contained in each.

1.0 INTRODUCTION

The Introduction section provides the foundation for and establishes the tone of the test plan. It should bring the reader up to the necessary level of understanding so he/she can understand the rest of the document. One objective of the test plan introduction is to be able to place it in the technical report with minor changes. For example, change verb tenses from future to past. All of the following elements that are applicable to the test should be included in the Introduction section. If there are unique elements that are specific to your test and not listed below, add them in the appropriate place. In addition, if some elements do not apply to your test, delete them. The reader must be able to understand your test plan without referring to the reference material.

1.1 General

The General section should include the purpose of the test plan and the following information:

a. System Program Office

b. The program authority **-** Program Management Directive number

c. Precedence rating

d. Job Order Number

e. Responsible test organization and responsibilities

f. Participating test organization(s) and responsibilities

g. Time frame for testing

h. Number of tests

i. Test location(s) (include ground and flight tests, and simulation tests if appropriate)

j. Test hours (flight and ground)

1.2 Background

The Background section should include at least the following information:

a. A brief description of what the system under test is (maximum of two sentences).

b. A summary of significant historical data leading up to the test.

c. A discussion of previous related tests, problems found, and significant results. How did we get here (approximately one paragraph)?

d. A list of significant phases of the test (approximately one paragraph).

1.3 Test Item Description

Describe what is going to be tested. Include a short overall description and a simplified block diagram, if appropriate, of the item to be tested. More indepth descriptions (over one page) should be included in an appendix. Include reference(s) to documents that contain detailed descriptions (e.g., flight manual, specifications, etc.). Make certain the test article is identified as production representative, proof-of-concept, etc., for purposes of the test. Identify any peculiar configurations required.

1.4 Overall Test Objective

Use one or two clear sentences to describe the overall test objective.

1.5 Limitations

Discuss limitations that apply to the test. Do not include flight manual or other published limitations that can be referenced without losing the continuity of the test plan. Items that might be considered are:

a. **The System Under Test** (e.g., F-16 T/N 123 has never flown straight since it came out of the factory, but it is the only F-16 available for the test. Although the trim required is small and the effect on test results is judged to be small, there is no way to quantify the differences between this aircraft and a straight jet for the purposes of these tests.)

b. **Test Instrumentation** (e.g., The instrumentation is only capable of recording 10 samples per second. The frequency of measurand X is 15 Hz; therefore we will not be able to measure with great confidence the peak values of measurand X. Depending upon the level of importance of peak values in measurand X this may be a factor in the evaluation, but initial judgment indicates that stabilized values will be sufficient to perform the evaluation.)

c. **Test Facilities** (e.g., In order to fully evaluate the targeting system, over 500 simultaneous threats would be required. However, only 250 are available in the chamber. This is a known risk and the program office is willing to accept the test results for this limited test as indicative of the true performance of the targeting system.)

d. **Associated Test Vehicles** (e.g., The T-38 will be used as a target. Even though the T-38 RCS is not identical to the actual intended target, no actual targets are available. Test results must be carefully considered before making decisions as to design improvements or production decisions.)

e. **Weather** (e.g., Every attempt will be made to test the article in three successive MIL-STD desert diurnal cycles; however, current weather patterns indicate that the probability of achieving this is low and the test article is not available at any other time for these tests. Careful consideration must be made relative to the test results and the associated risk of fielding the system without testing in the proscribed MIL-STD conditions.)

1.6 Test Resources

List all resources required to transmit, record, or display test data. List all other resources required to conduct the mission (e.g., aircraft, ranges, hardware, software, facilities, personnel, etc.). The Test Resources section includes, but is not limited to, the following sub-elements:

1.6.1 Modeling and Simulation

Computer simulation consists of digital modeling of the avionic system, the host platform, other friendly players, the scenario, the combat environment, and threat systems. These models are then executed interactively in simulated time and space domains. Specific computer simulations are constructed at levels of detail which roughly correspond to the level of technical complexity they support (i.e., engineering, platform, or mission). Computer simulation and analysis is used prior to each phase of testing to help design the tests and predict test results and, after each phase of testing, to extrapolate test results to other conditions. In this way, computer simulation serves to tie the five other test facility resources together.

Briefly describe resources for accomplishing any computer and mathematical modeling required for the test. Identify responsibilities for modeling. Briefly identify responsibilities for simulator operation, maintenance, and programming. Reference documents containing detailed simulation and laboratory requirements, if appropriate. However, the reader must be able to understand your test plan without referring to the reference material. Some examples of modeling and simulations are: Digital Simulation Takeoff and Landing, TAC BRAWLER, TAC SUPPRESSOR, and Enhanced SAMS.

1.6.2 Test Facilities

Test facilities can be contractor or Government owned and are brought together under five categories: measurement facilities, system integration laboratories (SILs), hardware-in-the-loop (HITL) facilities, installed system test facilities (ISTFs), and open-air facilities. Measurement facilities provide capabilities to explore and evaluate advanced technologies, antenna patterns, and electromagnetic (e.g., radio frequency, infrared, laser) signatures. The SILs are facilities designed to integrate aggregations of avionic hardware and software, up to an entire aircraft avionic suite, in a laboratory spread-bench configuration. The SILs are used to evaluate the operation/performance of individual components and subsystems in the context of their interactions with other avionics. The SILs often employ a variety of real-time/near real-time digital models and computer simulations to generate scenarios and electromagnetic backgrounds. These models are interfaced with brassboard, prototype, or actual production hardware of the systems under test. The SIL testing focuses on identifying hardware and software problems, maturing system performance, and evaluating projected reliability and maintainability levels. When SIL testing has been completed, engineering prototype components should be transferred to HITL facilities. The HITL test facilities are indoor laboratories which provide a secure environment to test avionic system hardware against manned, closed-loop simulations. The HITL facilities allow production systems to be tested under controlled and repeatable test conditions. The ISTFs provide a capability to evaluate avionic systems which are installed on, or integrated with, host platforms. These test facilities consist of anechoic chambers in which free-space radiation measurements are made during the simultaneous operations of all host platform avionics. The ISTFs primary purpose is to evaluate integrated avionic systems (e.g., radar, infrared, communications, navigation, identification, electronic combat or subsystems, integrated controls and displays) in installed configurations to test specific functions of complete, full-scale weapons systems. Such testing is conducted to determine if any electromagnetic interference or electromagnetic compatibility problems exist; to determine reaction to electromagnetic environments of hostile and/or friendly systems whose signals cannot be radiated in free space on open-air test ranges for security reasons; and to support flight testing by providing preflight and postflight checkout capabilities. Open-air facilities are used to evaluate the system under natural environment operating conditions. They are used to determine the effects of real-world phenomena on the system under test. Real-world phenomena encountered during open-air testing include terrain effects, multi-path propagation, and commercial electromagnetic interference (television and radio broadcasts, microwave communications, etc.). Some examples of facilities that fall under each of these categories are listed below. See the appropriate SFTC office, AFMAN 99-110, *Airframe-Propulsion-Avionics Test and Evaluation Process Manual* (Reference 6), and AFMAN 99-112, *Electronic Warfare Test and Evaluation Process* (Reference 7) for a more complete list.

a. **Modeling and Simulation Facilities**

1. Test and Evaluation Mission Simulator (TEMS)

b. **Measurement Facilities**

1. Rome Laboratory (RL)
2. Stores Weight and Inertial System Facility

c. **System Integration Laboratories**

1. Electronic Warfare Avionic Integration Support Facility (EWAISF)
2. Integrated Defense Avionic Lab (IDAL)
3. Integration Facility for Avionic System Testing (IFAST)
4. Missile/Munition Integration Facility

d. **Hardware-in-the-Loop Facilities**

1. Air Force Electronic Warfare Evaluation Simulator (AFEWES)
2. Aircraft Gun Harmonization Facility (Gun Butt)

e. **Installed System Test Facilities**

1. Air Combat Environment Test and Evaluation Facility (ACETEF)
2. Benefield Anechoic Facility (BAF)
3. Preflight Integration of Munitions and Electronic Systems (PRIMES)

f. **Open-Air Facilities**

1. Air Armament Center (AAC)
2. Air Force Flight Test Center (AFFTC)
3. Kwajalein Missile Range (KMR)
4. Multispectral Open-Air Test Environment (MORTE)
5. Naval Air Warfare Center, Weapons Division (NAWCWPNS)
6. Nellis Range Complex (NRC)
7. Utah Test and Training Range (UTTR)
8. White Sands Missile Range (WSMR)

Briefly describe each facility to be used during each phase of the test. Reference documents containing detailed facilities descriptions, if appropriate. Again, the reader must be able to understand your test plan without referring to the reference material.

1.6.3 Frequency Authorization

To use or operate any Spectrum Dependent System (i.e., equipment that radiates or receives RF energy), you must obtain frequency authorization from the Installation Spectrum Manager (ISM). To obtain frequency authorization contact the Spectrum Management Office (SMO) (95 CS/SCML) as soon as possible in the planning cycle. Frequency authorization must be obtained for any equipment that radiates or receives RF energy regardless of power or frequency of operation. For established test facilities, frequency assignments for equipment such as telemetry systems and tracking radars are apt to already be in place, but programs must still contact the SMO to obtain a radio frequency authorization (RFA) prior to operations. Equipment that only receives RF energy also requires a RFA due to the high probability that it will collect sensitive or classified information.

To obtain authorization to use frequencies that are not already assigned to the AFFTC, a frequency assignment request must be submitted by the SMO for the program in accordance with AFI 33-118, *Radio Frequency Spectrum Management* (Reference 8), AFMAN 33-120, *Radio Frequency (RF) Spectrum Management* (Reference 9), and AFFTCI 33-11, *Assignment and Control of Radio Frequencies* (Reference 10). Frequency requests require 120 days to process per AFI 33-120 (Reference 9) so it is imperative that programs contact the SMO as soon as possible in the planning cycle. An electronics countermeasures (ECM) clearance is required to perform all electronic attack (EA) or ECM activity and must be conducted in accordance with CJCSM 3212.02. The ECM clearances may require national level approval depending on the frequency bands selected which may require additional time for coordination. All ECM activity performed by flights originating from the AFFTC and operating in the R-2508 or adjacent ranges must contact the SMO to ensure an ECM clearance has been established (by AFFTC or other ranges) for their activity. Once an RFA is obtained, the program may have to schedule the use of the frequencies covered in the RFA through range scheduling (412 TW/OSS/OSCS). This is normally done for all shared bands including telemetry, flight termination, and ECM activities to de-conflict use and to ensure interference-free spectrum is available for all R-2508 complex users. It should also be noted that a RFA is only an authorization to use particular frequencies; it does not constitute a bar to other activities or programs use of those same frequencies. Spectrum use will be de-conflicted by time or area of operation to prevent interference between organizations.

If an organization receives harmful interference they will immediately contact the SMO and an interference control team will be dispatched to locate and terminate the interference source. It is imperative that contact with the SMO take place as soon as possible to give the team as much time as possible to resolve the interference. For critical missions the SMO interference team can be placed on standby to continuously monitor critical frequencies (such as flight termination). This can be done to identify and record interference in a near real-time fashion, thereby preventing the interference.

1.6.4 Test Aircraft

Briefly describe the test aircraft which will be used for the test or will carry the item under test, the test configuration required, and any related onboard instrumentation (i.e., GPS, INS, other reference systems). Do not include flight manual limitations. Identify any flight certification requirements as a result of the test or aircraft modifications in accordance with AFMCI 21-126, *Temporary 2 (T-2) Modification of Aerospace Vehicles* (Reference 11). Reference documents containing detailed test vehicle descriptions, if appropriate.

1.6.5 Support Vehicle

Briefly describe any support vehicle(s) which might be used as targets, target launch vehicles, test and checkout systems, operational satellites, safety/photo chase, etc., the configuration required, and any related onboard instrumentation (i.e., GPS, INS, other reference systems). Identify any flight certification requirements as a result of the test or aircraft modifications in accordance with AFMCI 21-126 (Reference 11). Reference documents containing detailed aircraft descriptions, if appropriate.

1.6.6 Test Range

Describe test range resources required for the test including, but not limited to, the following:

a. Tracking radar(s)

b. Telemetry

c. Cinetheodolites

d. Airspace

e. Threat simulators, surrogates, and signal sources

f. Secure communications

g. Inter-range links

h. Mission/range control

Identify range responsibilities and required coordination. Reference documents containing detailed range descriptions, if appropriate.

1.6.7 Instrumentation Requirements

Briefly describe the instrumentation required (i.e., transducers, video cameras, spectrum analyzers, etc.) to support the test. Also, identify any significant instrumentation equipment which must be purchased, developed, or modified to conduct the test. Discuss calibration procedures for all instrumentation systems. Complete details about instrumentation parameters should be placed in the Parameter List appendix. Detailed descriptions of the instrumentation system should be placed in the Instrumentation Plan appendix. Reference documents containing detailed instrumentation descriptions, if appropriate.

Safety and test go/no-go parameters must be clearly stated. These are the parameters that **must be** working to continue the test safely and the parameters that **must be** working to gather the minimum data to satisfy the test requirements. **The significance of the go/no-go parameters is that if any one of them is not working you either go to some other test that does not require the parameter or stop the testing altogether until the instrumentation is repaired.**

1.6.8 Test Support Facilities and Equipment

Briefly describe each significant item of test support facilities and equipment (i.e., age equipment, cranes, trucks, labs, hangers, etc.) other than that used for instrumentation for testing. Identify all test support facilities and equipment that must be developed or modified to conduct the test. Reference documents containing detailed equipment descriptions, if appropriate.

1.7 Safety Requirements

Safety during testing is in large part a function of how well a test is planned. Frequently, tests are designed to evaluate system performance limits, and evaluating system limits can be hazardous. Proper planning is an important element of keeping testing hazards within acceptable limits. All appropriate safety requirements, reviews, and documentation should be stated in this element (Reference 3).

This section should include any specific safety considerations that are appropriate, such as:

a. Speed and altitude restrictions

b. Center of gravity restrictions

c. Weight restrictions

d. Air space restrictions

e. Antenna mounting restrictions

f. RF output power restrictions and safety zones

g. Handling of hazardous materials and chemicals

h. Accident risk assessments

i. Mishap plans

1.8 Security Requirements

This element should tell the reader what security procedures will be enforced before, during, and after the test. Cite the authority for each type of security required. More indepth descriptions (over two pages) should be included in an appendix. Each of the security issues below must be considered by the test engineer regardless of the overall classification of the program. The following sections will frequently apply.

1.8.1 General Security

Discuss the overall security procedures to be enforced and the authority for them. Discuss how classified material will be marked, handled, and accounted for. If there are special security procedures for this test, briefly state them in this section.

1.8.2 Operations Security

Briefly discuss the operations security procedures to be enforced and the authority for them. If there are special operational security procedures for this test, briefly state them in this section.

1.8.3 Communications Security

Briefly discuss the communications security procedures to be enforced and the authority for them. If there are special communications security procedures for this test, briefly state them in this section.

1.8.4 Competition Sensitivity

If there is competition-sensitive information associated with the test, state that fact and describe how the competition-sensitive information will be protected. If the test is conducted during a source selection, reference should be made to any special instructions required by the source selection plan.

1.9 Test Project Management

Show in a block diagram the overall project management and organization. List in a table the key Government and contractor personnel, along with phone numbers, e-mail address and organization, with responsibilities essential to the implementation of the test(s). Provide a program schedule showing the significant milestones of the test program.

1.10 Test Environment

Briefly describe the location(s), time(s) of day, weather, and RF conditions required for the tests.

1.11 Environmental Impact Assessment

There are numerous National and State environmental laws that may effect a test project. These laws pertain to many items including air pollution, noise pollution, waste disposal, disturbing the ground in air drop zones, fuel spills, etc. The program office is responsible for dealing with these laws at the program level. For tests conducted at or by the AFFTC, the AFFTC Environmental Management Directorate (AFFTC/EM) should be consulted at the very beginning of the project. Appendix D contains a checklist that must be reviewed and attached to each DTP.

If all the answers on the checklist are NO, put the following phrase in your test plan:

"Based on the attached Environmental Checklist, significant impacts on the human environment are not likely and no further environmental documentation is needed."

If you answer YES or DON’T KNOW to one or more questions on the checklist, call AFFTC/EMXC for consultation and guidance.

2.0 TEST AND EVALUATION

The Test and Evaluation section is where you detail what you are going to do and what you expect to find. Write in Air Force terms using simple sentences. Include sufficient detail so that it is clear what you are going to do and what you expect to find. Figures, plots, and tables are appropriate in this section, but should be stand-alone. Highly detailed or complex figures, plots, and tables should go into an appendix. Avoid excessive use of acronyms and abbreviations. In this section, it never hurts to spell it out. If you come up with a new technique or data gathering concept, mention it here but describe it thoroughly in an appendix. Just how much detail to put in this section versus the appendices is always a judgment call. Be thorough yet concise. The Test and Evaluation section includes the following elements.

2.1 General

In this element, restate what the test program is, where it will be conducted, and when it will be conducted. Also state the number of tests and test hours planned and the different configurations where applicable. If a test matrix is applicable, refer to it here. Also state how deficiencies or deficiency reports (DRs) will be handled when applicable.

2.2 General Test Objectives

A general test objective is a qualitative statement of a broad performance or technical parameter to be measured during a test. General test objectives include two or more specific test objectives and usually come from the Test and Evaluation Master Plan. If general test objectives are needed a table should be included that lists all of the general and specific test objectives. Examples of general and specific test objectives are:

a. **General Test Objective**: Determine whether the installation of the dual actuators on the aft cargo door meets functional requirements.

b. **Specific Test Objective**: Determine if the aft cargo door will uplock during flight at airspeeds up to 185 knots.

c. **General Test Objective:** Measure and evaluate the reliability and maintainability (R&M) and diagnostic paramaters of the B-2A weapon system, identify deficiencies and make an assessment of military utility.

d. **Specific Test Objectives:**

1. Measure and evaluate the reliability parameters of the B-2A weapon system, individual systems and components.

2. Measure and evaluate the maintainability parameters of the B-2A weapon system, individual systems and components.

3. Measure and evaluate the diagnostic parameters of the B-2A weapon system, individual systems and components.

4. Identify and document weapon system and components deficiencies which impact the R&M and diagnostic performance of the B-2A.

5. Provide B-2A R&M data as necessary.

For any given test project, there may be a large set of possible test objectives. Test objectives are derived from operational requirements defined by the operational commands, which, through analysis, are translated into technical requirements necessary to meet the operational need. Sources for the development of test objectives include system specifications, ORDs, MNSs, TEMPs, DRs or MC Form 37s from previous systems or versions, and system functions. All test objectives should be traceable back to one or more of these sources. Figure 2 shows a block diagram indicating the various inputs that make up the test objectives and their associated measures of performance.

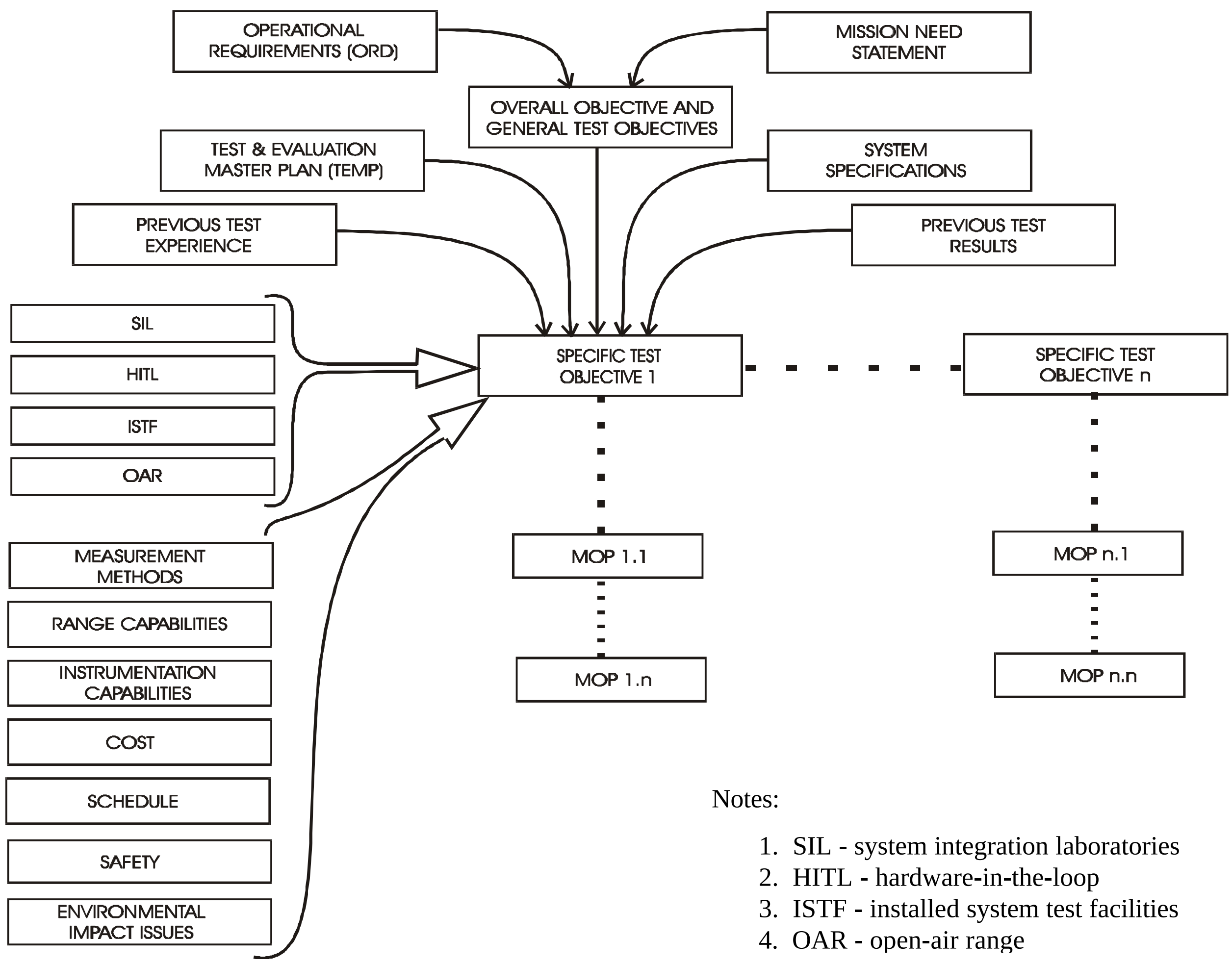

Figure 2 Test Objective and Measures of Performance (MOPs) Input

2.3 Specific Test Objectives

Test objectives are qualitative statements of what is to be answered by the test system (i.e., performance goals) with respect to the individual characteristics associated with each subsystem function. Test objectives should be short definitive statements beginning with an action verb followed by the object or qualifying phrases. Two action verbs typically used to indicate the intent and scope of testing are verify and evaluate. Table 1 defines verbs that should be used to indicate the intent and scope of the test. Although contractors may produce test plans that call for tests to verify or demonstrate; testers at the AFFTC are strongly encouraged to use objectives that determine or evaluate. Even though the Air Force may be involved in an IPT that chooses to compare or demonstrate; at the end of the test project the Air Force personnel will be evaluating the weapon system from the Air Force perspective.

Countless hours are spent haggling over which verbs to use for a given objective. Table 1 provides the necessary insight so that the test plan preparer has a better appreciation for which verb to use. Noah Webster, Funk and Wagnalls, and Cambridge never anticipated that testers would have so much trouble with these little words. The task of writing a sound objective is not easy and as such should not be taken lightly. Your worth as a tester will be judged on your ability to write sound objectives and to later write a report which, believe it or not, hinges on how well the objectives were written. By considering the MOP, success criteria, and evaluation criteria as you write the objective, the correct verb will become apparent.

Table 1
VERB DEFINITION

Verb	Action	Typical Use	Level of Evaluation
Observe	To watch carefully, especially with attention to detail or behavior for the purpose of arriving at a judgement.	Observe the radar altimeter display over nonlevel terrain while maneuvering.	Low because no measure of the overall worth is made. Typically used when the AFFTC is hired to gather data for an external Government agency or contractor. Pilot and engineer observations are delivered to the customer along with the data at the end of the test.
Compare	To examine in detail the likenesses and differences in the quality or performance of the test items.	Compare the detection range of the APG-66 versus the APG-70.	Low because no measure of overall worth is made.
Demonstrate	To reveal something qualitative or quantitative which is not otherwise obvious.	Demonstrate that the C-17 can back up a 2-percent grade using thrust reverser.	Low because no measure of the overall worth of this function is made. Little or no relevance is made as to whether the test subject accomplishes the test with ease or its last breath. It either passes the test or it does not.
Determine	To discover certain measurable or observable characteristics of a test item.	Determine the maximum grade a C-17 can back up.	Some engineering expertise might be required to interpolate test results if all we had was a 2-percent ramp and a 5-percent ramp. The test article did fine on the 2-percent ramp but did not make it up the 5-percent ramp. The engineer would then have to use engineering expertise to determine what grade the C-17 could make it up.
Evaluate	To establish overall worth (effectiveness, adequacy, usefulness, capability) of a test item.	Evaluate the APG-66 radar maximum detection range.	High. This is the favorite AFFTC verb. Requires test expertise, corporate knowledge, and operational sense in order to perform the evaluation. Requires the maximum range to be determined, then an evaluation of the worth of that much range (e.g., offensive capability, weapons deployment advantage, etc.).
Verify	To confirm a suspected, hypothesized, or partly established contention. Implies use of a statistical evaluation.	Verify the APG-32 radar reboots less than once in 10,000 target acquisitions.	High. Requires concise knowledge of statistics in order to determine the number of acquisitions to perform in order to have a given level of confidence that the reboot rate has been determined.

Those objectives that can help show performance, functional limits, military worth, etc., are candidates for further consideration and must be further evaluated for practicality. Test objective practicality is determined by at least considering the following topics:

a. Achievability - Are sufficient measurement methods, test resources, and instrumentation available?

b. Executability - Can the objectives be accomplished within program limitations?

c. Safety - Can the test be performed safely?

d. Utility - Do the test objectives clearly and conclusively evaluate the desired feature?

e. Cost - Can the customer afford the cost of the objectives?

f. Schedule - Is sufficient time available to accomplish the objectives?

g. Environmental Impacts - Can the objectives be accomplished without adverse effects on the environment?

When stating the test objective, some questions to ask yourself are:

a. Is the objective stated clearly?

b. Does the statement contain more than one objective?

c. c. Is the verb in the objective supported by the methodology and data analysis sections (Table 1 contains verb definitions)?

d. Can the objective be accomplished within program limits?

e. What is the purpose of this objective?

f. Is a definition of terms needed? (For example: What is meant by a false alarm?)

The Test and Evaluation section should describe each test objective and its associated MOP. To adequately satisfy each MOP appropriate success criteria and evaluation criteria need to be stated. In addition, the data requirements, algorithms/processes, and final data products required to answer each MOP must also be stated. Finally, how each MOP will be accomplished and what results are expected must be defined. For test plans that have a number of different, not directly, related test objectives, the preferred organization is to have all pertinent write-ups in one section. An outline of this approach would look like the following:

- Test Objective 1
  - Measure of Performance 1
    - Success Criteria
    - Evaluation Criteria
    - Final Data Products
    - Data Requirements
    - Algorithms/Processes
    - Test Methodology
    - Expected Test Results
  - Measure of Performance 2
    - Success Criteria
    - Evaluation Criteria
    - Final Data Products

Data Requirements
Algorithms/Processes
Test Methodology
Expected Test Results
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.
.
Test Objective 2
Measure of Performance 1
Success Criteria
Evaluation Criteria
Final Data Products
Data Requirements
Algorithms/Processes
Test Methodology
Expected Test Results
.
.

The following sections describe the information that goes into each of the pertinent write-ups.

2.3.1 Test Objective 1

Clearly state in one or two sentences the first test objective. List all of the MOPs together in ascending order that fall under this test objective.

2.3.1.1 Measures of Performance

The process of reconciling test objectives with the desired test conclusion(s) starts with determining the MOPs for each test objective that, when known, will support the type of conclusions required. For example, if we want to conclude whether the maximum range of a system is satisfactory, then we might need an MOP of range versus altitude. From that MOP we would conclude if the system range is satisfactory.

A MOP is almost always a measure of system-specific design or performance characteristics (e.g., receiver bandwidth, rate of climb, etc.) that are needed to achieve a required operational capability. **(There is an exception to this when data are being collected solely to allow design engineers to troubleshoot a systems performance. This exceptional case will be discussed at the end of this section.)** Each MOP is written as a bullet statement or a single simple declarative sentence. The MOP is followed by a sentence or two that explains how the MOP will be measured, calculated, or observed. For example (taken from sample Human Factors, Flutter, and Reliability objectives, respectively):

MOP 1: Display legibility: Each aircrew member will qualitatively evaluate the legibility of the display.

MOP 2: Frequency, amplitude, and damping of wing motion: Frequency and amplitude of wingtip accelerometers will be recorded in real time on strip charts. Damping will be calculated in real time from the time histories.

MOP 3: Mean Time Between Maintenance Action (MTBMA): The MTBMA is calculated by dividing the total flying hours accumulated during the measurement period by the number of chargeable corrective maintenance events accumulated during the period. Ground operating hours will not be used in the calculation.

MOP 4: Mean Time To Repair (MTTR): The MTTR will be determined by dividing the total organizational level elapsed corrective maintenance hours by the total number of corrective maintenance events. Corrective maintenance hours do not include delay times.

MOP 5: Built-In Test (BIT) Detection Capability: The BIT detection capability is the ability of on-aircraft fault detection systems to determine the presence of a malfunction and provide an indication to flight and maintenance crews.

2.3.1.1.1 Success Criteria

Success criteria determines how much good data of each type are required for the test to be judged a success. They also determine how the quality of the data will be judged. The question to be answered is: How will I know when I have enough data to evaluate the system relative to the MOP? This is a very important consideration in an environment of limited funds for DT&E. **It is important to not waste time and money collecting more data than is necessary**. **It is also important for the test team to establish and agree on the success criteria at the beginning to avoid disagreements on when to stop testing once the project is under way.**

The tester should have a good understanding of the meaning of precision, accuracy, standard deviation, and confidence levels. Unfortunately many testers do not have thorough knowledge of complicated statistics, and program schedule and cost constraints limit the amount of data that can be collected. Therefore, testers are strongly encouraged to consult with senior, experienced testers on establishing the minimum number of required test points.

Remember that success criteria has nothing to do with whether or not the system meets its design goals. Success criteria tells you when you have sufficient data (quantity and quality) to make an evaluation.

Do not confuse the test success criteria with the programmatic requirement to develop a certain minimum capability. The program may have to go through numerous iterations of 'fly-fix-fly-fix-fly' to develop the minimum capability. The test conducted after each fix has its own success criteria. Some examples are:

MOP 1: Display legibility - Success Criteria: Qualitative assessment of the display’s legibility by eight aircrew members current in the aircraft.

MOP 2: Frequency, amplitude, and damping of wing motion - Success Criteria: All the test points in Table 6 are completed with a damping ratio greater than 2 percent; or when a test point shows a damping ratio of less than 2 percent, at which time testing will cease.

MOP 3: Mean Time Between Maintenance Action (MTBMA) - Success Criteria: Acquire joint reliability and maintainability evaluation team (JRMET) reviewed reliability data through the end of the DT&E flight tests. All chargeable corrective maintenance events, regardless of number, that occur during DT&E will be used in the database.

MOP 4: Mean Time To Repair (MTTR) - Success Criteria: Acquire sufficient JRMET approved R&M data through the end of the DT&E flight test program.

MOP 5: Built-In Test (BIT) Detection Capability - Success Criteria: Acquire sufficient JRMET approved R&M and BIT data through the end of the DT&E flight test program.

Success criteria are usually as simple as a certain number of test points, a certain number of hours of operation, or achieving some minimum level of performance. **However, establishing a success criteria based on a sound statistical analysis takes some effort and a good knowledge of statistics.** If a particular confidence level is required, make sure you have enough data samples to calculate that confidence level. If you know your data is going to be limited, because of not having more than one or two trained pilots, or not enough repetitions of the test under the same conditions, state that in the success criteria. For example, a minimum of two pilots will complete the questionnaire, however these results will only be descriptive and not inferential in nature. A successful test is defined as one in which the data are sufficient in quantity and quality for derivation of the intended test results. Sometimes these results cannot be statistical because of limited resources during flight test.

2.3.1.1.2 Evaluation Criteria

Evaluation criteria are used to 'evaluate' each MOP in terms of the specified, or desired, system design or performance. Evaluation criteria are statements of what will be considered satisfactory performance for the MOP. They are usually stated as a single sentence or a table listing minimum performance under certain conditions.

Each MOP will be evaluated to determine its acceptability or quality in terms of system design or performance. Each MOP must be addressed. The test engineers may use their experience and engineering judgment to combine results from individual MOPs to provide an evaluation of system performance at the test objective level. Some MOPs will be clearly stated as specification compliance items given to the test team by the program office. Other times it will be up to the test team to determine what is satisfactory performance. Some examples are:

MOP 1: Display legibility - Evaluation Criteria: The legibility of the display will be considered satisfactory if seven of the eight aircrew rate it as satisfactory according to the criteria listed in Table XX.

MOP 2: Frequency, amplitude, and damping of wing motion - Evaluation Criteria: The frequency, amplitude and damping of wing motion will be considered satisfactory if the damping is 2 percent, or greater, at all test conditions shown in Table Y; and the frequency and amplitude of the wingtip oscillations fall within the design goal portion of Figure ZZ.

MOP 3: The Mean Time Between Maintenance Action - Evaluation Criteria: The MTBMA will be considered satisfactory if it is greater than 120 hours at the conclusion of the DT&E project.

MOP 4: Mean Time To Repair (MTTR) - Evaluation Criteria: The demonstrated MTTR at the end of the DT&E flight test program shall be less than 4.5 hours.

MOP 5: Built-In Test (BIT) Detection Capability - Evaluation Criteria: The BIT system shall detect not less than 95 percent of the malfunction which occurr on the aircraft during the DT&E flight test program. This requirement shall apply only to malfunctions of components which are equipped with BIT.

2.3.1.1.3 Exceptional Case to MOP

There are occasions when a system is not performing as intended and the design engineers will want to gather data for the sole purpose of trying to figure out what is going on inside the system (e.g., trouble shoot). In this case there is no MOP in the sense of meeting a specification or satisfying some military utility. However, there is a MOP in the sense of gathering the data required to make the analysis. Therefore, typical words for this situation would be:

Objective: Gather data to allow for the analysis of the ___________(fill in the appropriate issue or subsystem being investigated)_________.

MOP: Record each of the data parameters shown in table XX with sufficient fidelity to allow for the analysis of the __________(fill in the appropriate issue)________.

Success Criteria: All the test points in Table YY are accomplished.

Evaluation Criteria: Designers agree data is sufficient to allow them to analyze the ________(fill in the appropriate issue________.

2.3.1.1.4 Evaluation Terminology

Conclusions and recommendations in the report are made based on how well the MOP meets the evaluation criteria. Having clearly-defined evaluation criteria that are agreed to prior to the start of the test project, is critical to the ultimate success of the test project. Without clearly-defined criteria the test team will have a difficult time determining when testing is complete and what recommendations should be made to the program office.

Once all the evaluation for all the MOPs is completed the overall worth or utility of the system can be assessed. The information provided below is extracted from AFFTC-TIH-97-01, *Writing AFFTC Technical Reports* (Reference 12), and provides guidance on the use of the AFFTC standard descriptors.

Use the AFFTC Descriptor Evaluation Scale (Table 1, page 40 [Reference 12]) when choosing your words for the overall conclusions.

One of the most important, and sometimes difficult, aspects of report writing is to accurately convey the relative importance of results, conclusions, and recommendations. It often takes considerable effort and discussion among the testers and authors to answer the questions, how good is good or how bad is bad? Do **not** reinvent the wheel. Considerable scholastic effort has been expended over decades to arrive at a set of descriptor adjectives and rating scales that mean about the same thing to most people. No set of words can hold exactly the same meaning for everybody; but the industry has established specific criteria and verification methods to ensure a good quality scale. Some scales and combinations of descriptors have already been validated. At the AFFTC the corporate knowledge on this subject resides in the Human Systems Integration Branch (i.e., Human Factors). ***Before attempting to apply any scale or set of descriptors in your test efforts your first action should be to contact the Human Systems Integration Branch for guidance!***

The following discussion explains the AFFTC's standard policy on descriptors, scales, and how to apply them. This guidance should apply in most circumstances; however, it may not apply to all circumstances and guidance from the Human Systems Integration Branch experts and the Technical Directorate management should be sought out if you have an exception.

a. **Consistency**. It is important that there be consistency between squadrons, and between various projects within a squadron, in the use of descriptors and explaining the magnitude of the 'satisfactory' or 'unsatisfactory' situation. The words used to describe the 'goodness' of update 'A' should be consistent with the words used to describe the 'goodness' of update 'F' 5 years later. It can be misleading to the program decision makers if one group of testers are hard graders and another are easy graders. Money could easily be spent in the wrong place if the relative importance of results, conclusions, or recommendations, for various modifications or weapon systems, is not reported to the program office with similar and consistent verbiage.

b. **Overall Rating.** It is AFFTC policy that when drawing formal conclusions (the words that will go in the Executive Summary and Conclusions and Recommendations section of your report) regarding the overall adequacy of the system under test, only the terms **Satisfactory**, **Marginal**, or **Unsatisfactory** shall be used. These three terms apply to the overall ability of the weapon system or major subsystem to accomplish its intended mission.

Note that 1) The accomplishment of specific tasks within a mission, and/or the ability of a single mode of operation of one piece of equipment, does not necessarily get a rating of **Satisfactory, Unsatisfactory,** or **Marginal**; and 2) Attempting to average a number of **Satisfactory**, **Unsatisfactory**, and **Marginal** ratings to come up with an overall rating is not advised. The overall rating is based on the ability of the system to accomplish the mission or how well the system meets critical requirements. It is the test team's job to use their collective wisdom to determine what is critical and what is not.

The descriptors and qualifiers used to describe how **Satisfactory**, or **Unsatisfactory**, and the urgency of corrective action are as follows:

(1) **Satisfactory.** In discussing degrees of **Satisfactory**; at the high end of this category, words such as Excellent, Outstanding, Superior, and First Rate, all convey a meaning of well-above mission requirements and expectations.

In the middle range of the **Satisfactory** category, words such as Good and Very Good convey a meaning of meets mission requirements and expectations and imply that the system is good enough as is. Any recommended changes would fall in the categories of minor improvements or enhancements.

In the low range of the **Satisfactory** category, approaching the Marginal category, the words Fair, Pretty Good, and Tolerable convey a meaning of meets mission requirements but not expectations. The system can do the job, but not as well as it ought to. Recommended changes would fall in the category of desirable improvements to operability or increases in capability.

(2) **Marginal. Marginal** is used when the collective wisdom of the test team can not clearly call a system under test satisfactory or unsatisfactory; or, when some items are satisfactory and others are unsatisfactory so that only some of the mission requirements can be accomplished satisfactorily. If some requirement that is deemed critical by the test team is not met, the overall rating should probably be unsatisfactory.

The words Borderline, Just, and Barely convey a meaning that the system is at the minimum level of acceptable quality and did not meet expectations. For example a task could just barely be accomplished with considerable pilot effort. Recommended changes fall in the categories of highly desirable or strongly recommended to reduce the risk of failure in operational testing or in field use.

Of all the words used in Table 1 (Reference 12), **Marginal** is the most controversial and has the greatest variability of meaning between individuals. There is no consensus on whether **Marginal** is ‘marginally satisfactory,’ or ‘marginally unsatisfactory,’ or if it can be used in either context. Therefore, to clearly convey to the reader a **Marginal** rating, the reason for using **Marginal** must be completely explained in clear and simple language. **Marginal** tends to be an ambiguous term and your explanation in the text must eliminate the ambiguity.

(3) **Unsatisfactory.** In discussing degrees of **Unsatisfactory**, words such as Deficient, Poor, Unsuitable, and Bad imply a system that does not meet some critical mission requirements. Recommended changes would include significant changes required to achieve satisfactory capability.

For systems that are more severely deficient, the addition of ‘very’ or ‘extremely’ to the words above convey a meaning that the system does not meet most critical mission requirements. Recommended changes would be in the category of major changes required to achieve satisfactory mission capability.

Unusable and Unsafe or Dangerous form a negative extreme. The system will not meet mission requirements, either because it lacks the capability, or because operational use of the system is deemed unsafe. Recommendations associated with this category fall in the Mandatory classification.

Table 1 provides a summary of the above discussion.

Table 1
AFFTC DESCRIPTOR EVALUATION SCALE

How Well Does the System Meet Mission/Task Requirements	Descriptors	Rating	Nature of Recommended Changes
Some or all requirements very well met.	Excellent, Outstanding, Superior, First Rate	**Satisfactory**	None Required
Some or all requirements well met; good enough as is.	Good	**Satisfactory**	Enhancements
Meets requirements; can do the job, but not as well as it could or should.	Fair, Pretty Good, Tolerable	**Satisfactory**	Desirable Improvements to Capability or Usability
Minimum level of acceptable capability and/or some noncritical requirements not met.	Borderline, Just or Barely	**Marginal**	Highly Desirable/Strongly Recommended to Reduce Risk in Operational Test or Field Use
Does not meet some critical requirements.	Poor, Deficient, Unsuitable, Bad	**Unsatisfactory**	Substantial Changes Required to Achieve Satisfactory Capability
Does not meet most critical requirements.	Very or Extremely Bad, Poor, Deficient, Unsuitable	**Unsatisfactory**	Major Changes Required to Achieve Satisfactory Capability
Mission not possible.	Unusable, Unsafe or Dangerous	**Unsatisfactory**	Changes Mandatory to Meet Mission or Make Safe

Extracted from Reference 12

c. **Scales.** Numbers are assigned to rating scales when it is deemed appropriate to convert subjective data into some kind of a numerical database for statistical analysis or graphical presentation. This situation is often associated with a questionnaire to solicit aircrew or maintainer opinions.

For the most common and broadest situations facing the testers several scales have been validated and are considered standard.

Do *not* attempt the construction of a questionnaire or rating scale without first consulting the Human Factors engineers (Human Systems Integration Branch) who have studied the subject in considerable depth.

The AFFTC's general rule is that 6-point scales will be used; with exceptions as shown below or after you consult with the experts. The experts reside in the AFFTC's Human Systems Integration Branch. The numeral '6' is assigned the high end of the scale; the best of the good. The numeral '1' is assigned the low end of the scale; the worst of the bad.

(1) The Cooper-Harper rating scale (Appendix F) is standard for its intended purpose. Modified Cooper-Harper scales are not considered standard, nor should the Cooper-Harper scale be applied to situations other than its original intent.

(2) A general purpose scale that can be applied to many situations like; rate the ability of a given modification, piece of hardware, or subsystem to support a given mission or given task; or rate the ability of the human in the loop (pilot, crew chief, maintainer) to perform a given task or achieve the desired level of performance (roughly equate this to grading students on an exam):

6 - very satisfactory
5 - satisfactory
4 - marginally satisfactory
3 - marginally unsatisfactory
2 - unsatisfactory
1 - very unsatisfactory

(3) How much better or worse a given modification is than the original configuration (this is one exception to the 6-point rule):

5 - much better
4 - better
3 - about the same
2 - worse
1 - much worse

2.3.1.1.5 Final Data Products

The final data products are the tables, charts, plots or other illustrations that you will use in the technical report to display your final test results. They are the final output product(s) from the data reduction and analysis that will be inserted into the final report, progress reports, preliminary report of results, and/or technical letter reports. Conclusions and recommendations must be supported by test results.

Generally, an analytical product must be both desired and achievable if it is to be used in a test report. The following summarizes the possibilities to be considered.

Case	Desired	Achievable	Results
1	Yes	Yes	Tested and reported
2	No	Yes	Not tested or reported
3	Yes	No	Not tested or reported
4	No	No	Not tested or reported

Case 3 is the one to watch out for. If an analytical product is desired but cannot be achieved, then you will not get the data you need to meet your objective. Perhaps something is not testable or the desired conclusion cannot be determined from testing. Cases 2 and 4 are invalid cases and should not be in the test plan. Be sure your planned final products are achievable while still in the project's test planning phase.

If possible, insert samples of tables, plots, etc., into the data analysis plan that will be used to support your conclusions and recommendations in the final report.

Keep in mind the general flow of individual datum through conclusions and recommendations. Data are collections of individual measurands obtained for each test point. Results are a collection of data in a format that matches the evaluation criteria. Results are viewed as the facts concerning the system’s performance. Evaluation is the process of determining how well the system meets its evaluation criteria and what that means operationally. Results are used to do the evaluation. Conclusions are statements of 1) whether or not the system met the evaluation criteria, 2) the system’s overall worth or utility, and 3) impacts of the system’s performance on operational use. Recommendations are statements of suggested improvements or, suggested next action for the program office.

2.3.1.1.6 Data Requirements

After the test objectives, MOPs, success criteria, and evaluation criteria have been determined, it is possible to identify data that need to be acquired. It is essential that all required data be identified. If the list of specific data elements is too large or the instrumentation system(s) outputs a standard set of data parameters, then list the data sources and refer to the complete list of specific data elements in the Parameter List appendix. This appendix lists all the data sources and the specific data parameters or output products of each.

2.3.1.1.7 Algorithms/Processes

After the test objectives, MOPs, success criteria, evaluation criteria, and data requirements have been determined, it is possible to identify the algorithms or processes that need to be performed on the data. Identify how data will be processed and test results generated. Describe the equation(s) and/or processes that will be used to produce the final data product(s). Identify or describe all necessary parameters that make up the equation. For small and simple test plans this can be done in the body of the plan. For large and complicated tests this should be done in a Data Analysis Plan appendix.

2.3.1.1.8 Test Methodology

The test methodology element briefly describes the test conditions and procedures associated with the MOP to acquire the appropriate information to adequately answer the MOP.

2.3.1.1.9 Expected Test Results

Discuss the expected test results for the MOP. Provide, or reference, results of any modeling, computer simulation, system integration lab, hardware-in-the-loop, installed system test, and/or previous open-air test performance relevant to the MOPs. This element is intended to provide a feedback loop to all previous testing and to serve as warning that something may not be right if the actual results do not match expected results. Remember that all test plans are management tools. This element should force the test team to do sufficient homework to recognize when something in the data may be outside of predictions or some subsystem is malfunctioning. The expected result is the warning horn to tell the test team to stop testing and investigate the cause of the unexpected result. The cause may be a malfunctioning piece of test instrumentation, a lack of understanding of how the system should work or a malfunction in the system under test.

3.0 TEST PROCEDURES

This section briefly summarizes how testing will be accomplished. The Test Procedures section includes, but is not limited to, the following elements.

3.1 Pretest Briefing/Test Readiness Review

Describe who will attend (i.e., SPO, contractor, PTO) and what will be addressed in the pretest briefing. Indicate test team responsibilities for conducting pretest briefings. Typical topics for the pretest briefing are:

a. System under test status and checkout performance

b. Instrumentation status and checkout performance

c. Ground station status and checkout performance

d. Software and hardware configuration

e. Test objective and procedure review

f. Schedule

g. Test coordination

h. Security

i. Safety

j. Success Criteria

k. Go/No-Go Criteria

l. Real-time data requirements to include format, algorithms, and data definitions

m. Quick-look data requirements to include format, algorithms, and data definitions

n. Final data requirements to include format, algorithms, and data definitions

3.2 Test Execution

Identify the positions to be manned. Discuss the use of test information sheets and make reference to their location. If test information sheets are not used, then detailed test execution procedures must be included here that support each test objective.

3.3 Post-Test Briefing

Describe who will attend (i.e., SPO, contractor, PTO) and what will be addressed in the post-test briefing. Indicate test team responsibilities for conducting post-test briefings. Each organization or agency participating in the test will submit a written mission summary following each test.

The summary will include an evaluation of the system under test performance, comments on test conduct, and a list of problems faced during the test including equipment malfunctions and failures. Typical topics for the post-test briefing are:

a. System under test status

b. Instrumentation status and performance

c. Review and discussion of test events

d. Data requirement review

e. System under test performance review

f. Test product identification and delivery to include real-time, quick-look, and final products

g. Review of systems

h. Contractor equipment performance

i. The RTO equipment performance

j. The PTO equipment performance

k. Submission of written summaries

l. Reference sources performance

m. Test support sources performance

n. Review and discussion of test

o. The software version

p. Any software changes and impacts to the program

q. A list of test objectives for the next mission

4.0 TEST REPORTING

The Air Force's test organizations mission is to test and evaluate aerospace systems and report the results. Results can be communicated in various forms such as a progress report, test and evaluation result sheet (TERS), preliminary report of results (PRR), technical letter report (TLR), or a technical report (TR). The AFI 99-101 Reference 1 gives basic guidance on what is included in test reports and when they are delivered. AFFTCI 99-3, *AFFTC Technical Report Program* (Reference 13) gives specific guidance on AFFTC reports that includes; their content, appropriates uses, size; schedules and expected practices. The AFFTC-TIH-97-01 (Reference 12) gives detailed guidance on the format of AFFTC reports. All three of these documents ***must*** be read and understood not just before test planning begins, but at the time the AFFTC commits to participate in a test project. The tester and program office must have a common understanding of what is to be reported, how long it will take, and how much it will cost. These decisions must be made, and agreed to, before the AFFTC can estimate the cost of its test effort. This section of the test plan tells the reader what test reports will be prepared, when, and by whom. A summary of the AFFTC report products is given below.

4.1 Deficiency Report

To ensure timely and proper identification of system deficiencies, the system program office should conduct a program deficiency reporting system in accordance with technical order (T.O.) 00-35D-54, *USAF Deficiency Reporting and Investigation System* (Reference 14), and AFFTCI 99-4, *Flight Test Center Deficiency Reporting* (Reference 15). The contractor(s) may use their own DR system; that system shall be compatible with the AF DR system and its use shall not negate the requirement to use the AF DR system as the official DR system for the test program.

4.2 Progress Report

The PR is a periodic report on test progress and interim test results. Its purpose is to keep the management organization apprised of test program progress. It is a concise document that does not contain detailed system descriptions or test procedures. It is normally based upon preliminary data.

4.3 Test and Evaluation Results Sheet

The TERS is a very short report (three pages) addressing a single subject, which is one of many subjects to be addressed in the test project. It is primarily used to transmit data to the program office as various subsets of tests are completed. A project may generate many TERS during the course of the project, and the TERS may be included as appendices of the final technical report. It is completed in less than 30 days from last test.

4.4 Preliminary Report of Results

The PRR is primarily intended as a management-oriented TR and briefing that is delivered to key decision makers when they need information quickly. It presents results, not analysis. It is a standup briefing and prepared in briefing slide format. It summarizes the results in management terms from a management perspective. It is completed less than 30 days after the last test.

4.5 Technical Letter Report

The TLR is a quick-reaction, abbreviated report of final test results. It contains many of the report elements found in a formal TR; however, the amount of detail in each element is significantly reduced. It is limited in length (no more than 10 pages of type written text) and is prepared in a standard Air Force letter format. It is completed in less than 90 days after the last test.

4.6 Technical Report

The formal TR is a detailed report that presents analyses, evaluation, results, and the conclusions and recommendations of the test program. It may be any length and is the AFFTC’s final and official opinion of the system under test. It is completed less than 180 days after the last test.

5.0 LOGISTICS SUPPORT

5.1 General

Briefly describe the logistics support required for your test. If extensive logistics are required, details should go in a Logistics Support Plan appendix. The Logistics Support section includes, but is not limited to, the following items:

a. Transportation

b. Shipping

c. Billeting

d. Support

e. Maintenance

f. Training

g. Administration support

h. Test and support personnel

i. Supplies

j. Schedule

BACKUP MATERIAL

REFERENCES

This section lists the books and papers referred to in the test plan in order of their initial appearance. Shown below are different kinds of references normally found in test plans.

Example Contractor Report:

1. *Flight Test of the Production F100-PW-220 Engine in the F-16*, TIS FA1198 General Dynamics Fort Worth Division, Fort Worth, Texas, revised 2 June 1986.

Example AFFTC Technical Report:

2. Newell, Keith A., First Lieutenant, USAF, *F-16/F100-PW-220 Production Engine Flight Test Evaluation Volume I of II*, AFFTC-TR-86-44, AFFTC, Edwards AFB, California, March 1987.

Example PIDS:

3. *Prime Item Development Specification for Turbofan Engine F100-PW-2230*, 16PRXXXX, Pratt and Whitney Aircraft Group, West Palm Beach, Florida, 14 July 1980.

Example Reference Manuals:

4. *Altitude Tables*, 1962 United States Standard Atmosphere, AFFTC, Edwards AFB, California.
5. *Performance and Flying Qualities UFTAS Reference Manual*, AFFTC, Edwards AFB, California.
6. DeAnda, Albert G., *AFFTC Standard Airspeed Calibration Procedures*, AFFTC-TIH-81-5, AFFTC, Edwards AFB, California, revised June 1981.

Example Aircraft Flight Manual:

7. *Flight Manual, USAF Series Aircraft, F-16C*, Technical Order 1F-16C-1, General Dynamics Fort Worth Division, Fort Worth, Texas, 23 July 1984.

Example Book:

8. Parkinson, C. Northcote, *Parkinson's Law and Other Studies in Administration*, Houghton Mifflin Company, Boston, Massachusetts, 1957.

Example Journal Article:

9. Carrier, G.F., "Heuristic Reasoning in Applied Mathematics," in Quarterly of Applied Mathematics, Vol. XXX, No. 1, Brown University, Providence, Rhode Island, William Byrd Press, Richmond, Virginia, April 1972, pp. 11-15.

Example Contribution to Symposium or Conference:

10. Brown, R.C., *Fatigue, Fact or Fiction?*, in Symposium on Fatigue (eds. Floyd, W.F. and Welfird, A.T.), held by Ergonomics Research Society, Cranfield, England, 24-27 March 1952, H.K. Lewis and Co., Ltd., London England, 1953, pp. 24-27.

Example Military Specification:

11. *Military Standard Climatic Extremes for Military Equipment*, MIL-STD-210B.

APPENDICES

Appendices contain supplemental information that clarifies or supports the test plan. The titles of the appendices may take on many different names depending upon the type of program. The following are examples of titles and information contained in appendices and their order, if used.

a. Test Condition Matrix

b. Requirements Traceability

c. Parameter List

d. Data Analysis Plan

e. Instrumentation Plan

f. Logistics Support Plan

TEST CONDITIONS MATRIX APPENDIX

The test conditions matrix is a short-hand method that summarizes test events and resources needed to accomplish the test program. The test conditions matrix should be one of the early planning tools that outlines the scope of the test program and ensures that no holes are left in the planning process. It should be reviewed at early test plan working groups and may be a driver for putting together a statement of capability for a test program. The test conditions matrix can be sorted on many things so that it can be used to allocate resources real time. For example, someone can quickly look at a specific run and get an idea of what the run is all about. If an emitter went down during a run, a test conductor could quickly look at the test conditions matrix and substitute another run, thus limiting the dead time and waste of money and resources. The type of information presented in the test conditions matrix will vary widely with the type of testing. The information is best presented in a tabular format with columnar headings of specific information pertinent to the test. Some items that can be considered for column headings are:

1. Test conditions or test event number
2. Aircraft sector
3. Test aircraft altitude
4. Support aircraft altitude
5. Test aircraft airspeed
6. Support aircraft airspeed
7. Dry run (no jamming/no stores release)
8. Wet run (with jamming/stores release)
9. Angle of attack
10. Flight Pattern
11. Background emitters
12. Jamming techniques
13. Instrumentation required
14. Priority
15. Aircraft configuration
16. The TIS number
17. The MOP number
18. Launch window
19. Orbit inclination
20. Trajectory

REQUIREMENTS TRACEABILITY APPENDIX

The Requirements Traceability appendix should cross-reference the test objectives and MOP to the requirements document (i.e., TEMP, ORD, specifications, etc.) from which the objective is derived. **The chart below is an example** of how this may be done. The requirements correlation matrix (RCM) required for the TEMP should be brought forward and placed in the test plan Requirements Traceability appendix. Figure 2 (page 21) shows the various inputs that go into determining the test objectives and measures of performance. If a given test objective is based on a verbal agreement, state and name the parties. For purposes of continuity, the cross-referencing of test objectives to requirements might also contain requirements that are not part of the current test. Examples are previous tests, lab tests, etc., that have lead up to the current test.

When the requirements traceability is completed, all test objectives and MOPs should be traceable to a requirements document or verbal agreement. If an objective cannot be traced to a requirement, then that objective is suspect. The question to be addressed is: "Why is an untraceable objective in the test plan?"

EXAMPLE REQUIREMENTS TRACEABILITY CHART

Objective	Primary Introduction Document	Test and Evaluation Master Plan	System Maturity Matrix	Operational Requirements Document	Mission Need Statement	System Specification
1. Signal Identification 2. Tracking 3. Threat Direction Finding 4. Turn Performance 5. ... 6. ... 7. ...		para...	para...	para...	para...	para...

PARAMETER LIST APPENDIX

The parameter list (Table 2) is put together by the instrumentation engineer from the project engineers' data requirements. There needs to be good communication among the project engineer, the data analyst, and the instrumentation engineer. This is to ensure that the right parameters are being recorded and that the right algorithms are being used to provide the correct data products in order to adequately answer the measures of performance.

Table 2
PARAMETER LIST

Parameter No.	Parameter Name	Location	Range	Units	Resolution	Accuracy Pct Full Scale	Sample Rate (sps)	Remarks

DATA ANALYSIS PLAN APPENDIX

BACKGROUND

The Data Analysis Plan (DAP) appendix contains detailed and explicit data analysis methodology, procedures, and algorithms that are important but too detailed for the body of the integrated test plan (ITP) or detailed test plan (DTP). The body of the test plan usually provides an overview of the data analysis approach, algorithms, and perhaps some data analysis methodology. Also, the body of the test plan generally does not contain detailed calculation procedures unless absolutely required for clarity. Thus, the detailed level of the DAP will usually be different for each test.

The DAP must reflect the test plan objectives and must not have the appearance of an independent and unrelated document. This is an important consideration because the test plan and the DAP could be written by two different people who potentially have a different perspective of any given test. This issue can be addressed from at least two perspectives:

1. First, the DAP author needs to be aware of and refer to test plan measures of performance (MOPs) where appropriate when discussing how each MOP is calculated.

2. Second, an MOP cross-referencing table (Table 3) should be provided that cross-references test plan objectives and MOPs to the DAP paragraphs.

Table 3
EXAMPLE MEASURE OF PERFORMANCE (MOP) CROSS-REFERENCE TABLE

Objective No.	MOP No.	Data Analysis Plan Paragraph	Quick Look	In Depth	Calculation
1	1	4.1.1	X	X	Manual evaluation during test
2	1 2	4.2.2 4.2.1		X	Track accuracy Target report ratio
3	1	4.3.1	X	X	Extraction ratios
4	1	4.4	X	X	Correlation ratios

The DAP appendix should provide a perspective for the tasks required to reduce test data to meaningful results. This section should also give an idea of how long it will take before answers concerning previous tests can be obtained. This information will help with planning for future tests during test execution.

A DAP is not a substitute for experience; however, the best written DAP would be thorough enough and clearly written, that a new test engineer unfamiliar with the project, could proceed from the original measurands to the final data products with no assistance from another individual. Such a document requires considerable thought and time to write.

The DAP should be prepared, reviewed, and approved by technical experts and senior project personnel before the complete test plan is submitted for final approval. On large projects the DAP may take longer to write than the entire rest of the ITPs and DTPs. Test engineers must keep this fact in mind. Work must begin on the DAP at the earliest possible time in the planning process. Major data analysis decisions may have to be made before test procedures, and test instrumentation decisions can be made. How the data is reduced, processed, and analyzed will dictate test procedures and instrumentation requirements, and vice-versa.

DATA ANALYSIS PLAN ORGANIZATION

The DAP usually contains the following sections:

1. Required Data
2. Data Media and Data Format
3. Data Reduction
4. Data Analysis
5. Data Analysis Products
6. Data Distribution
7. Hardware and Software Requirements

Each section is described in detail below.

Required Data

Required data generally falls into one of the following four categories:

1. System under test data
2. Reference data
3. Related data
4. Derived data

System under test data are recorded to evaluate certain aspects of the system under test. Reference data are data assumed to be correct and that provide the standard against which other test data are compared (e.g., data from previous tests on the same aircraft). Related data are supporting data (e.g., a map of terrain flown over for a terrain-following radar test). Derived data are data obtained by combining other data. All data required for the MOPs should be specified in detail. The following information should be known and documented for each data element:

1. Name
2. Source
3. Engineering units
4. Zero reference
5. Update rate
6. Maximum value
7. Minimum value
8. Resolution
9. Accuracy

Tables should be used where appropriate, particularly when data elements are used repeatedly for many MOP calculations. Reference a system data catalog if one is available. If a data element is the result of a process other than recording (e.g., pilot opinion), describe the process and how that data element is generated (e.g., filling out questionnaires). All other data and sources not listed as data elements that will be recorded should also be described in this section. Some examples are:

1. Test log(s)

2. Video recordings

3. Flight log(s) and aircrew comments

4. Test engineer notes

Data Media and Data Format

Data media and data format must be fully documented for every data element that will be required for data analysis. Examples of analysis data elements are: data acquired during the test, previous test data, modeling data, electronic order of battle (EOB) data, terrain data, etc. Data used during data analysis should be included. It is essential that the type of media and data format be described in complete detail. If data are to be exchanged between organizations, the type of media and in what format these data will be provided should also be fully explained. If there are one or more interface control documents (ICDs) for the test, then summarize formatting information here and refer to the ICD.

Data Reduction

Data reduction is the process of converting, extracting, and formatting data such that it can be accepted by data analysis tools. All required data reduction should be described for every data element that will be processed. Two examples of data reduction are: converting multiplexed bus data into digital data, and extracting a section of map data for background display. Another example of data reduction would be the need to run onboard instrumentation data through a ground processor to change it from analog recordings to digital engineering units before it can be used for analysis.

Data Analysis

Data analysis is the process of scrutinizing the data to ensure its correctness, deriving MOPs, and comparing to the evaluation criteria. In general, this section should describe all of the steps required to get from reduced data to the final calculated results; usually a MOP. Explain how the data will be processed and what calculations will be performed to obtain each of the test plan MOPs. Document in as much detail as required for the reader to clearly understand all of the analysis steps from beginning to end in chronological order. Be sure to describe the steps in the process where engineering judgment is required (e.g., pilot workload is not easily quantifiable). However, the collective judgment of several experienced pilots can determine if the workload for a given task is more, or less, than what operational pilots would consider satisfactory.

It must be clear to the reader how each calculation performed is related to each MOP and to each objective. Having a MOP to DAP cross-reference table (Table 3) accomplishes the required cross referencing between DAP paragraphs and the MOPs and test objectives. For continuity, the DAP calculation paragraphs should address the MOPs and their algorithms in the same order as stated in the test plan as much as possible. When describing each calculation, be sure to use the same data element names throughout all sections so that each data element can be traced back to its origin. If MOP calculations are duplicated with different data elements, fully describe the calculation process for the first MOP. For subsequent MOPs, identify the variables that are changed and refer back for the calculation details. Calculations such as time adjustment and coordinate transformations should also be included here. If the analysis methods or the calculations to be performed are described in a handbook, summarize and refer to the handbook. Provide time estimates for the calculations to be performed.

Data Analysis Products

The DAP appendix should identify documents in which data analysis products are required and in what format. For example; real-time, quick-look, final TR, and tables, plots, calculated numbers, etc.

Data Distribution

List or provide a table of who is to get what data. Identify the number of copies each will receive. If the data must go through some preprocessing prior to distribution, describe the steps it must go through before it can be distributed. State who is responsible for the processing and distribution.

Hardware and Software Requirements

In general this section should provide insight into how applicable existing data analysis tools are and how much new capability is required. Identify what facilities and what hardware and software will be used to perform the data reduction and analysis. Provide a flow chart, if appropriate, overviewing the data reduction and analysis process with input and output products at each stage. Provide time estimates for new capability development and acquisition.

INSTRUMENTATION PLAN APPENDIX

The Instrumentation Plan appendix describes the details of all of the instrumentation system(s); how they will be connected, what they will capture, etc. It is important to note that the instrumentation plan can change throughout the test program as the need for information changes. In order for instrumentation personnel to write the Instrumentation Plan appendix, they need to know some specifics early on in the program so that they can begin to design it. The vehicle that provides this information is the parameter list. The instrumentation plan is primarily put together by the instrumentation engineer in cooperation with the project engineer and the data analyst. The Instrumentation Plan appendix should describe the instrumentation system(s) in enough detail in order that if the same instrumentation system could be used in the future, it would not have to be redesigned. Include any diagrams, where appropriate, that describe the instrumentation system and its relationship to the system under test.

The following is a list of specifics that is generally included in the Instrumentation Plan appendix:

1. Data format

2. How data will be captured

3. Volume of data

4. Space and power availability

5. Pre- and postflight procedures

6. Beacon requirements

7. Temporary 2 (T2) modification paperwork

8. Frequency authorization of beacons, telemetry, etc.

LOGISTICS SUPPORT PLAN APPENDIX

The Logistics Support Plan appendix describes all logistics details required to execute a test. For those tests in which logistics requirements are not applicable, simply delete this appendix from the test plan. For those elements following in which logistics requirements are worked after test plan completion, the updated schedules, worksheets, letters, etc., shall be attached to the master or file copy of the test plan. The test engineer shall maintain this information such that the most current state of planning is easily available for review. The following elements should be considered for the Logistics Support Plan appendix.

GENERAL

Describe logistics requirements. Be sure to identify unique or special requirements that might not normally be expected.

TRANSPORTATION

Describe what and when transportation requirements are needed for personnel and equipment. Include points of contact: names, phone numbers, and addresses. Some methods of transportation to consider are:

1. Air Mobility Command
2. Dedicated aircraft
3. Commercial aircraft
4. Government ground vehicles
5. Privately owned vehicles

SHIPPING

Discuss who is responsible for shipping equipment, supplies. etc., and how they will be shipped (e.g., commercial freight, Federal Express, United Parcel Service, U.S. Mail). Also discuss which items are required to be packaged and the shipping point of origin. Indicate who is responsible for the packing lists describing the contents of the items to be shipped. Information that is commonly required on packing lists includes:

1. Nomenclature
2. Manufacturer
3. Model number
4. Serial number
5. Whether it is automated data processing (ADP) equipment
6. Weight
7. Size

If the items to be shipped are classified, indicate who will provide AF Form 310 Document Receipt and Destruction Certificate, or equivalent, describing each classified package and its contents prior to acceptance by couriers or shipping. Discuss all security aspects required for shipping of classified material. Your security officer will be of valuable help in answering many of the questions that arise when shipping classified material.

BILLETING

Describe what billeting arrangements are needed for whom, when, and where. Include points of contact: names, phone numbers, and addresses.

SUPPORT

Describe what support is needed from whom and when. Include points of contact: names, phone numbers, and addresses. Support topics to be considered are:

1. Aircraft support
2. Equipment support **-** including the contractor
3. Supply support
4. Security support

MAINTENANCE

Describe what maintenance is needed from whom and when. Include points of contact: names, phone numbers, and addresses. Maintenance topics to be considered are:

1. Aircraft maintenance
2. Ground vehicle maintenance
3. Equipment maintenance **-** both AFFTC and contractor
4. Portable and fixed facilities maintenance
5. Spares
6. Availability of technical data

The test for completeness of this element is whether the reader feels comfortable that sufficient maintenance requirements have been identified and arranged for such that the test can be successfully executed.

TRAINING

Describe what training is needed from whom and when. Include points of contact: names, phone numbers, and addresses. Training topics to be considered are:

1. Maintenance training requirements
2. Aircrew training requirements
3. Engineer training requirements
4. Driver licenses for forklifts, military vehicles, etc.
5. Test equipment operation
6. System under test reference operation

ADMINISTRATION SUPPORT

Describe what administration support is needed from whom and when. Include points of contact: names, phone numbers, and addresses. Administration topics to be considered are:

1. The need for picture IDs, passports, Government IDs, etc.
2. Who will request/transmit security clearances?
3. Who will be responsible for TDY orders?
4. How messages will be sent between test site(s) and the applicable project office.
5. How personnel will obtain expense money when remote.

TEST AND SUPPORT PERSONNEL

Indicate the total number of personnel and organizations assigned to the test. In addition to test teams being comprised of personnel from the responsible test organization (RTO), test teams are often comprised of personnel from the System Program Office, the user command, the contractor, and participating organizations. State how many personnel from each organization will be required to support the test and the responsibilities of each person.

It is usually desirable to include a summary table of key personnel showing their breakdown by major task and organizational category (e.g., RTO, PTO, contractor, etc.). A table will usually be helpful in presenting the test and support personnel data including social security numbers. This section will overlap the test procedures section somewhat; however, the emphasis here is on ensuring that the proper number and type of personnel are associated with each task type.

SUPPLIES

Discuss who will provide for all, or a portion of, office supplies, magnetic media, and documentation required to execute a test. List the items to be supplied. Discuss the test media requirements and how these requirements will be satisfied. Relate the media requirements to each phase of the test. Show how the amount of required media is calculated or estimated. Use a summary table, if appropriate. The reader should be comfortable that all phases of the test requiring media are considered. Identify what media is needed from whom and when. Distinguish between contractor-supplied media and Government-supplied media. Indicate what documentation is required to support the test (e.g., test plans, technical orders, operational manuals, software books, etc.). Include points of contact: names, phone numbers, and addresses.

SCHEDULE

Show a schedule describing all aspects of logistics. As a minimum, cover all of the elements described above.

LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS

One of the most difficult aspects of writing for engineers to master is effective use of shorthand notations: abbreviations, acronyms, and mnemonics.

1. **Abbreviations** generally are created by shortening a word and representing the word by that shortened form i.e., ft for foot. Another form of abbreviation is created by taking the first letters of a phrase and using the initials to represent the phrase, i.e., USA for United States of America. Many abbreviations are understood by the general public. Most are readily understood by readers familiar with a particular subject.

2. **Acronyms** are new words created by pieces of other words or, again, the first letters of the phrase to be shortened, i.e., radar for radio detection and ranging. Acronyms tend to be recognized only by readers very familiar with a particular subject. However, some are in such common usage that the acronym is recognizable by a wide range of readers, most of whom do not know the full underlying phrase. Radar is a very good example of this.

3. A **mnemonic** is really a memory mechanism, not truly an abbreviation, nor an acronym. In software and cockpit design, it is common to call special parameters or certain operating modes by a short-hand word that calls to mind the entire meaning of the phrase, i.e., RMAX for maximum range or DTOS for the dive toss bombing mode.

Abbreviations, acronyms, and mnemonics should only be used in technical writing to assist the reader in understanding quickly and accurately what the author is trying to convey. Abbreviations should not be made up and used if they conflict with a generally recognizable abbreviation. If a writer was to use USA for Under-Sea-Amphibian, the reader might become confused while reading the test plan several pages after the abbreviation was defined.

Acronyms, likewise, should only be used when they bring clearer understanding to the reader. Many acronyms are used as a shorthand by project personnel, but are not understood outside the small group. Beware of that type of acronym in a test plan; it almost always will confuse the readers in the coordination and approval cycle.

Normally mnemonics should not be used as shorthand for a system operating mode when discussing that mode in a test plan. A few have become reasonably well known, but not many. It is best to stick to clear text when writing about system modes and leave the use of mnemonics to the computer programmers and cockpit designers.

Defining an abbreviation, acronym, or mnemonic before using it is accomplished by placing the shorthand in parentheses immediately after the phrase. For example, time of arrival (TOA). Note that acronyms and mnemonics are almost always written in upper case. That fact should not necessarily be construed to mean that when defining the term, each word must start with a capital letter. This is only the case where the term is a proper name. The basic instructions call for defining an abbreviation the first time it is used in each of the major sections of a test plan. Abbreviations and acronyms should periodically be redefined for clarity in lengthy text. If the reader is not thoroughly familiar with the subject, he or she may forget the more obscure abbreviations.

Do not define an abbreviation if it is never used again. There is, however, an exception. In a very few instances, the abbreviation may be more recognizable than the actual word or phrase. By seeing the abbreviation, the reader is clearer on the author's meaning. In some cases like this, the abbreviation may not actually require definition, e.g., TACAN. The abbreviation may be better understood than the full phrase.

One final issue is the forming of plurals and possessives from abbreviations, acronyms, and mnemonics. A possessive is formed by adding ..'s and a plural by adding ...s. For example, the abbreviation for System Program Office is defined as SPO, the possessive form is SPO's and the plural form is SPOs.

The following guidelines should be used when writing this test plan element:

1. Abbreviations and symbols should be defined in all major heading sections including the appendices. They may be redefined at any time for clarity if desired.

2. Common units of measure such as feet, pounds, inches, miles, etc., are to be spelled out in the text of the test plan but abbreviated in tables and figures. All abbreviations and symbols, including the most common ones, should be listed and defined in the List of Abbreviations, Acronyms, and Symbols. They should be alphabetized as follows:

   a. Capital letters precede lower case letters and Greek letters

   b. Superscripted and subscripted terms are treated as horizontal letters

   c. Numbered subscripts follow in numerical order

(See the Master List of Abbreviations, Acronyms, and Symbols section for accepted abbreviations and those commonly used acronyms that do not have to be defined when first used.)

DISTRIBUTION LIST

The distribution list is the last page of the test plan. The author, in conjunction with his technical and project managers, determines the contents of this list through correspondence with the program management office. The proposed list should be included in the coordination copy for review. Some organizations that may want copies of test plans are:

1. Test organization's (test squadron, combined test force, etc.) program office

2. Authors’s home office (if different from test organization)

3. Participating test organizations (contractors, using command, etc.)

4. Air Force Flight Test Center (AFFTC) Technical Library (It is AFFTC policy that **three copies** of **all AFFTC test plans** will be placed in the AFFTC Technical Library.)

5. OT&E agencies

REFERENCES

1. AFI 99-101, *Developmental Test and Evaluation*, 1 November 1996.

2. AFFTCI 99-1, *Test Plans*, 1 October 1997.

3. AFFTCI 91-5, *Test and Safety Review Process*, date TBD.

4. Defense Acquisition Deskbook, Version 1.4, March 31, 1997. http://www.deskbook.osd.mil

5. DoD 5230.25-PH, *Control of Unclassified Technical Data with Military or Space Application*, May 1985.

6. AFMAN 99-110, *Airframe-Propulsion-Avionics Test and Evaluation Process Manual*, 3 July 1995.

7. AFMAN 99-112, *Electronic Warfare Test and Evaluation Process -- Direction and Methodology for EW Testing*, 27 March 1995.

8. AFI 33-118, *Radio Frequency Spectrum Management*, 1 August 1997.

9. AFMAN 33-120, *Radio Frequency (RF) Spectrum Management*, 1 June 1997.

10. AFFTCI 33-11, *Assignment and Control of Radio Frequencies*, Not yet published.

11. AFMCI 21-126, *Temporary 2 (T-2) Modification of Aerospace Vehicles*, 11 April 1997.

12. AFFTC-TIH-97-01, *Writing AFFTC Technical Reports*, Revision 4, October 1997.

13. AFFTCI 99-3, *AFFTC Technical Report Program*, 2 November 1998.

14. T.O. 00-35D-54, *USAF Deficiency Reporting and Investigation Sy*stem, 15 July 1994.

15. AFFTCI 99-4, *Flight Test Center Deficiency Reporting*, 26 May 1998.

16. DoD 5200.1-PH, *DoD Guide to Marking Classified Documents*, April 1997.

17. AFI 32-7061, *The Environmental Impact Analysis Process*, 24 January 1995.

BIBLIOGRAPHY

1. American National Standard for Information Sciences - *Scientific and Technical Reports - Organization, Preparation, and Production. ANSI Z39.18-1987*.

2. MIL-STD-790, *Specification Practices*.

3. AFI 10-1101, *Operations Security*, 1 May 1997.

4. AFI 99-101, *Developmental Test and Evaluation*, November 1996.

5. AFI 99-102, *Operational Test and Evaluation*, July 1998.

6. AFI 99-109, *Test Resource Planning*, July 1994.

7. AFMC PAM 911, *Flight Safety and Technical Considerations Guide for Flight Testing*, 18 March 1997.

APPENDIX A

CLASSIFICATION REQUIREMENTS FOR TEST PLANS

The classification of test plans is covered by DoD 5200.1-PH, *DoD Guide to Marking Classified Documents* (Reference 16). This appendix in no way replaces nor supersedes this Air Force Pamphlet. It is merely intended to highlight some important terms.

In accordance with these instructions, certain elements of the test plan have been selected to explain how to mark the basic page and items on the page.

FRONT COVER

The following items on the front cover require security classification markings:

1. <u>Top and Bottom Page Margins</u>. The highest overall classification (Top Secret, Secret/Special Access Required, Secret/No Forn, Secret, or Confidential) of the material contained within the document shall be marked in the top and bottom margins.

2. <u>Document Title</u>. The document title should be selected so as not to require classification. An unclassified title of a classified document will be followed by the symbol (U).

3. <u>Classification Authority Statement</u>. The Classified by authority, the Date Classified, and the Declassify on (date) or Downgrade to (date) shall be placed on the lower right-hand corner of all classified documents. (The author is responsible for supplying this classifying information.)

INSIDE FRONT COVER

<u>Top and Bottom Page Margins</u>. This test plan element is normally unclassified but carries the same classification as the front cover on the top and bottom margins.

PREFACE AND EXECUTIVE SUMMARY

The Preface and Executive Summary pages require the following security classification markings:

1. <u>Top and Bottom Page Margins</u>. The top and bottom margins shall be marked with the highest classification on that page.

2. <u>Title</u>. The title of the Preface and Executive Summary are normally unclassified and shall be marked with the unclassified symbol (U) enclosed in parenthesis to the right of the title.

3. <u>Text</u>. Paragraphs shall be marked with the applicable classification symbol enclosed in parenthesis—(TS), (S/SAR), (S/NF), (S), (C), or (U)—to the left of the first word in each paragraph.

TABLE OF CONTENTS

The Table of Contents requires the following security classification markings:

1. <u>Top and Bottom Page Margins</u>. The top and bottom margins shall be marked with the highest classification on that page.

2. Stand-Alone Titles. Titles as the PREFACE are normally unclassified and shall be marked with a (U) following the last word of the title. (Avoid classified titles whenever possible.)

3. Appendix Titles. These shall be marked with the applicable classification following the last word of the appendix title.

4. Figure and Table Titles. These shall be marked with the applicable classification symbol enclosed in parenthesis—(TS), (S/SAR), (S/NF), (S), (C), or (U)—preceding the title.

5. Only use portion markings on the Table of Contents, List of Illustrations, and List of Tables if there are one or more titles marked (TS), (S/SAR), (S/NF), (S), or (C).

MAIN BODY

The main body of the test plan requires the following security classification markings:

1. Top and Bottom Page Margins. The top and bottom margins shall be marked with the highest classification on that page.

2. If a paragraph splits over to the next page, it must carry its portion marking with it.

3. Section or Chapter Titles. Section or Chapter titles shall be indicated by the appropriate symbol in parenthesis—(TS), (S/SAR), (S/NF), (S), or (C)—immediately following the title. Normally these are unclassified and are followed by (U).

4. Paragraph Headings. Paragraph headings shall have the applicable classification symbol enclosed in parenthesis—(TS), (S/SAR), (S/NF), (S), or (C)—placed immediately following the last word of the heading. Normally these are unclassified and are followed by (U). If a paragraph heading is preceded by a section number, the classification symbol follows the section number and precedes the paragraph heading, such as: 3.2 (U) Test Execution.

5. Untitled Text. Untitled text shall have the applicable security classification symbol—(TS), (S/SAR), (S/NF), (S), (C) or (U)—preceding the first word of each paragraph, but following any letter or number designation.

6. Each page must carry the highest classification for that page, regardless of the classification shown on the reverse side of a double-sided page.

FIGURES

Figures in classified test plans require the following security classification markings:

1. Top and Bottom Page Margins. The top and bottom margins shall be marked with the highest classification on that page.

2. Figure Title. The appropriate security classification symbol—(TS), (S/SAR), (S/NF), (S), (C), or (U)—is placed after the figure number and just before the title. It indicates the classification of the figure title only.

3. Body of the Figure. The appropriate overall classification of the figure is typed in all capital letters and is placed within the body of the figure.

4. Notes: The appropriate portion marking for each listing will be placed between the number and the text, e.g., 1. (U) xxxx.

TABLES

Tables in classified test plans require the following security classification markings:

1. Top and Bottom Page Margins. The top and bottom margins shall be marked with the highest classification on that page.

2. Table Title. The appropriate security classification symbol—(TS), (S/SAR), (S/NF), (S), (C), or (U)—is placed after the table number and just before the title. It indicates the classification of the table title only.

3. Body of the Table. The appropriate overall classification of the table is typed in all capital letters, enclosed in parenthesis and placed one space above the table frame.

4. Notes placed under a table frame will carry portion markings.

5. Footnotes placed under a table frame will carry portion markings.

REFERENCES

The References section of test plans require the following security classification markings:

1. Top and Bottom Page Margins. The top and bottom margins shall be marked with the highest classification on that page.

2. List Heading. The list heading shall have a capital letter (U) after the word, e.g., REFERENCES (U).

3. Titles of Listed Documents. Titles of classified documents shall have the applicable classification symbol—(TS), (S/SAR), (S/NF), (S), (C), or (U)—placed after the last word of the title.

4. The classification of the document will be spelled out at the end of each reference (e.g., CONFIDENTIAL).

BLANK PAGES

Blank pages carry UNCLASSIFIED markings at the top and bottom margins of each page.

APPENDICES

Appendices in classified test plans require the following security classification markings:

1. Top and Bottom Page Margins. Top and bottom margins shall be marked with the highest classification on that page.

2. Appendix Heading. The unclassified symbol shall be placed to the right of the heading and letter designation of the appendix, e.g., APPENDIX A (U).

3. Appendix Title. The appendix title shall be marked with the applicable classification symbol—(TS), (S/SAR), (S/NF), (S), (C), or (U)—following the last word of the title.

4. Paragraph Headings/Untitled Text. Security classification markings for paragraph headings and untitled text in appendices are handled in the same manner as in the main body of the document.

LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS

No portion markings are required unless the abbreviation, acronym, or symbol itself is classified. In this case, the abbreviation or symbol shall be marked with the applicable classification symbol—(TS), (S/SAR), (S/NF), (S), or (C)—preceding the abbreviation or symbol.

DISTRIBUTION LIST

The distribution list is always unclassified. In the classified test plan, the distribution list shall be prepared with the top and bottom page margins marked with UNCLASSIFIED. No portion markings are required.

INSIDE BACK COVER

Top and Bottom Page Margins. This test plan element displays the same classification as the front cover on the top and bottom margins.

OUTSIDE BACK COVER

Top and Bottom Page Margins. This test plan element displays the same classification as the front cover on the top and bottom margins.

APPENDIX B

PROCEDURES

TEST PLAN TIMELINE

The test plan timeline will be different depending upon the test organization, the scope of testing (in terms of size), and the particular types of systems being tested. Because it is difficult to build a timeline that will be suited to all testing, any test plan timeline should be used as an aid by the test planner for estimating and planning time allotments during the test planning process. A timeline should identify time periods that are considered normal.

It is not always possible to have the amount of time indicated by a timeline prior to the start of test. However, be aware that the start of test date is usually inflexible and you must have an approved test plan prior to test. Not having a signed test plan prior to the test date will generate considerable management attention.

The challenge for the test engineer and the value of a timeline is recognition of the differences between the normal test planning and that which is actually available. Being aware of these differences allows the test engineer and management to be better aware of risks and the need for emphasis. The following are some examples of timeline events:

1. Begin test planning

2. In-house test plan preliminary review

3. In-house test plan briefing and review

4. The AFFTC technical review

5. The AFFTC approval

6. Start of testing

PROCEDURES

The AFFTCIs 99-1 (Reference 2) and 91-5 (Reference 3) provide the AFFTC’s formal policies for test plan technical and safety review and approval. Both of those instructions must be read and understood before writing the test plan.

The Coordination and Approval Process

Refer to AFFTCIs 99-1 (Reference 2) and 91-5 (Reference 3) for the details of the coordination and approval process.

At the AFFTC the final technical and safety approval is done at the same time. The package which is sent through command channels is usually referred to as the 'safety package.' However, it includes all technical as well as safety documentation. The AFFTCI 91-5 (Reference 3) explains how to put the safety package together.

Test Plan Revisions

For revisions that occur during the technical and safety review process, it is the author's responsibility to properly incorporate that revision into the final signatory copy of the test plan. If some confusion exists as to the intent or exact wording of the revision after the reviews are complete, seek advice from your supervisor. Upper management expects the revisions from the technical and safety reviews to be incorporated. Management does not have the time to coordinate on a test plan two or three times. For revisions to the test plan that occur during testing, refer to AFFTCIs 99-1 (Reference 2) and 91-5 (Reference 3).

Writing Do's and Don'ts

The following list contains general techniques for writing test plans. They are included here to standardize the readability of test plans.

1. Keep paragraphs short. Cover only one topic per paragraph and let a topic run for several paragraphs if necessary.

2. Use topic sentences. A paragraph may need a topic sentence—a generalization explained by the rest of the paragraph. Topic sentences help shape masses of information. Without them, some paragraphs make readers shrug and say, "So?"

3. Write actively. Passive writing is wordy, roundabout, and sometimes confusing. Most of your sentences should use the who-does-what order. By leading with the doer, you automatically avoid a passive verb. (Now and then, you can write passively if you have a good reason to avoid saying who or what has done the verb's action. This situation may occur if the doer is unknown, unimportant, obvious, or better left unsaid.)

4. Rely on everyday words. Don't use big words when little words will do.

5. Be concise. Concise writing includes only those ideas that readers need, and it gives those ideas no more words than they deserve. Careful audience analysis and a willingness to be hard on yourself are essential to conciseness.

6. Be precise. There are many words in the English language which have multiple meanings. After writing something, ask yourself if your words can be interpreted in a manner other than you intended. If so, select more specific words or phrases so that your meaning cannot reasonably be misinterpreted.

7. Do not start sentences with common abbreviations, acronyms, or with Arabic or Roman numerals.

8. Spell out common units of measure such as feet, pounds, inches, miles, etc., in the text, but abbreviate them in tables and figures.

9. Limit the use of one-sentence paragraphs to only those items that require special emphasis.

10. Be consistent in the use of descriptor adjectives and keep to an absolute minimum.

11. References should be made by adding (Reference ___) in the narrative with the reference number corresponding to the appropriate number in the list of references. They should be referenced consecutively as they appear in the test plan.

12. Separate numbers and units, e.g., 5 miles.

13. Use conjunctions rather than slashes (/).

14. Capitalize Figure, Table, and Reference when referring to them in the text.

15. Use the plural form of the verb with the word data.

16. Express integers whose absolute value is 10 or greater in Arabic numerals. Spell out integers whose absolute value is less than 10. In a sentence where any number is written in Arabic numerals, all other numbers in that sentence will be written in Arabic numerals. However, a unit of measurement, time or money which is always expressed in figures, does not affect the use of figures for other numerical expressions in the sentence (e.g., A team of four men ran the 1-mile relay in 3 minutes and 20 seconds).

17. Hyphenate unit modifiers, e.g., the 50-foot radius, the 3-mile sector.

18. Except for common abbreviations, acronyms, and symbols (these common terms are annotated with an asterisk in the master list at the end of this handbook) you must define them the first time they are used in each section of the test plan and include them in the List of Abbreviations, Acronyms, and Symbols.

19. Round numbers in columns to the level of significance, which is commensurate with the instrumentation system resolution capability, and the level of significance of the parameter in question.

20. If abbreviations and acronyms are plural and not possessive, use a lower case 's' and do not use an apostrophe, e.g., CTFs.

21. When defining abbreviations or acronyms, capitalize proper nouns only, e.g., Air Force Flight Test Center (AFFTC), but not line replaceable unit (LRU).

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APPENDIX C

TEST PLAN CHECKLIST

The test plan checklist can be used as a guide to ensure key information is not left out of the test plan. The checklist matches the elements of the test plan so that the information can be inserted in the proper section(s).

FRONT MATTER

_____ Has the appropriate title and author(s) been placed on the outside front cover?

_____ Has the classification authority statement been placed on the outside front cover, if applicable?

_____ Has the appropriate distribution statement and controlling office been placed on the outside front cover?

_____ Has the correct Job Order Number (JON) been placed on the test plan and the Form 5028?

_____ Have the appropriate author(s) signature blocks been placed on the test plan and the project manager's name on the Form 5028?

_____ Have the appropriate reviewing officials signature blocks been placed on the Form 5028?

_____ Has the Qualified Requesters Statement been inserted?

_____ Has the Preface addressed how this particular test plan fits into the overall test program, how it relates to previous test efforts, and its relationship to other test plans?

_____ Has the Executive Summary addressed the background information, the test item description, and stated the overall test objective?

_____ Have all figures been placed in the List of Illustrations?

_____ Have all tables been placed in the List of Tables?

BODY OF THE TEST PLAN

1.0 INTRODUCTION

1.1 General

_____ Has sufficient program information been provided in the test plan?

1.2 Background

_____ Has sufficient system background information been presented in the test plan?

1.3 Test Item Description

_____ Does the test plan contain a test item description?

1.4 Overall Test Objective

_____ Is the overall test objective clearly and concisely stated?

1.5 Limitations

_____ Are all test limitations clearly stated?

1.6 Test Resources

_____ Is the required mathematical and computer modeling scheduled or in progress?

_____ Is the required laboratory simulation time scheduled or is the scheduling in progress?

_____ Are all required test facilities and resources needed identified?

_____ Have all the required frequency clearances been obtained?

_____ Have required test and support aircraft been scheduled?

_____ Has the desired range configuration for each scenario been identified?

_____ Have alternate range configurations been anticipated?

_____ Have all instrumentation sources been identified?

_____ Has all required instrumentation been scheduled, checked for proper operation, and calibrated?

_____ Has all test support equipment been identified?

_____ Has all required test support equipment been scheduled?

1.7 Safety Requirements

_____ Have all RF output power restrictions been addressed?

_____ Have all safety zones been identified and prepared for?

_____ Have airspace restrictions been identified and accounted for?

_____ Is an aircraft mishap plan in place?

_____ Have all flight-related safety limits been addressed (e.g., weight, cg, speed, altitude, etc.)?

_____ Have accident risk assessments been addressed?

_____ If a safety review board is required, have preparations in accordance with (IAW) AF Form 28 been accomplished?

_____ Have the proper handling of hazardous materials and chemicals been addressed?

1.8 Security Requirements

_____ Have all general security issues been addressed in the test plan?

_____ Has the authority of the general security requirements been cited in the test plan?

_____ Have all general security briefing requirements been addressed?

_____ Have all operations security issues been addressed in the test plan?

_____ Has the authority for the operations security requirements been cited in the test plan?

_____ Have all operations security briefing requirements been addressed?

_____ Have all communications security issues been addressed in the test plan?

_____ Has the authority for communications security requirements been cited in the test plan?

_____ Have all communications security briefing requirements been addressed?

_____ Have arrangements been made to protect proprietary information?

_____ Have arrangements been made to protect competition-sensitive information?

1.9 Test Project Management

_____ Have all Government and contractor personnel with responsibilities essential to the implementation of the test been identified?

_____ Has the overall project management and organization been identified?

_____ Has a schedule been prepared showing all major milestones of the test program from test planning to final report?

1.10 Test Environment

_____ Has the testing environment been stated?

1.11 Environmental Impact Assessment

_____ Is an environmental assessment required?

_____ Has an environmental assessment been prepared?

2.0 TEST AND EVALUATION

2.1 General

_____ Has sufficient program information been restated?

_____ Have the handling of deficiencies or deficiency reports been stated?

2.2 Test Objectives

_____ Does your test plan identify clear and specific test objectives?

_____ Have specific measures of performance (MOPs) been identified for each test objective?

_____ Have specific test success criteria been identified for each MOP?

_____ Have evaluation criteria been identified for each MOP?

_____ Are the data presentation formats for items like plots and tables that are to be part of the test report specified in the test plan?

_____ Is it clear from the test plan how data will be presented in the final report?

_____ Are all data that are to be acquired identified in the test plan?

_____ If preliminary or modeling tests are required to determine adequate sample size for valid data reduction, have they been performed?

_____ Have the appropriate algorithms been identified showing how the data will be reduced to answer the MOP?

_____ Is the test methodology for each objective presented in a logical order?

_____ Is the test plan clear about how each objective will be accomplished?

_____ Are the operational modes defined by test scenario for each system under test, truth, and data acquisition system?

_____ Have the expected test results for each MOP been stated?

3.0 TEST PROCEDURES

_____ Have the pretest briefing topics, meeting attendance, and meeting formats been described in the test plan?

_____ Has the test execution process been defined in detail?

_____ Are the post-test briefing topics, meeting attendance, and meeting formats described in the test plan?

4.0 TEST REPORTING

_____ Has all test reporting and timeframe required been identified in the test plan?

5.0 LOGISTICS

_____ Have the overall logistics requirements been identified to support the test?

BACKUP MATERIAL

REFERENCES

_____ Have all references cited in the test plan been listed in the references section in order of hierarchy?

APPENDICES

Test Condition Matrix

_____ Have all runs or test conditions been cited in the Test Condition Matrix?

_____ Has enough information been cited in the Test Condition Matrix to get an idea of what the test(s) are about?

Requirements Traceability

_____ Have all the test conditions identified in the Test Condition Matrix been cross-referenced to each MOP?

_____ Have all the MOPs been cross-referenced to the applicable test objective?

_____ Have all the test objectives been cross referenced to the applicable requirements document such as the Test and Evaluation Master Plan?

Parameter List

_____ Has a parameter list from all instrumentation systems been included?

_____ Have all paper products (test logs, observer notes, etc.) been identified?

Data Analysis Plan

_____ If new data acquisition/reduction algorithms are required, are they defined?

_____ Have detailed algorithms been defined in order to answer each MOP?

_____ Have all formats for data acquisition requirements been defined?

_____ Are all data acquisition procedures included?

_____ Has the distribution of all data acquisition requirements been identified?

_____ Have procedures been defined for before, during, and after test data distribution?

_____ Are test data management procedures covered?

_____ Have the software and hardware been defined that are required or needed to accomplish the data reduction?

Instrumentation Plan

_____ Has all instrumentation along with hardware and software been identified?

_____ Have all instrumentation hookups been identified?

_____ Have all instrumentation limitations been identified?

_____ Have all instrumentation procedures been defined to support the test?

Logistics Support Plan

_____ Has transportation to and from the test site and any equipment pickup and delivery been arranged for?

_____ Has billeting been arranged for all test related personnel who require it?

_____ Will sufficient media be available during the test?

_____ Has all support been arranged for at the test site, at any en route stops, and at Edwards AFB?

_____ Has all required maintenance been arranged?

_____ If training is required, has it been arranged?

_____ Has required administrative support been arranged?

_____ Have security clearances been sent?

_____ Have security clearances been received?

_____ Have all deployment participants been fully briefed on all objectives, deployment schedules, etc.?

_____ Have specific primary and secondary assignments been given to all deployment participants?

_____ Are all deployment and operating personnel and procedures approved by the cognizant national agencies?

LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS

_____ Have all the abbreviations, acronyms, and symbols used throughout the test plan been identified alphabetically in the List of Abbreviations, Acronyms, and Symbols?

DISTRIBUTION LIST

_____ Has the approved distribution list identifying all the Government and contractor agencies that will receive a copy of the test plan been prepared?

APPENDIX D

ENVIRONMENTAL CHECKLIST

ENVIRONMENTAL CHECKLIST FOR AFFTC DEVELOPMENTAL, OPERATIONAL, OR FOLLOW-ON TEST & EVALUATION ACTIVITIES

Project Title: Date:

Name of Proponent/Point of Contact:

Organization/Office Symbol: Phone Number:

Purpose: To comply with Air Force Instruction (AFI) 99-101, Developmental Test and Evaluation, by identifying AFFTC developmental, operational, or follow-on test and evaluation activities requiring impact analysis as directed by AFI 32-7061, The Environmental Impact Analysis Process.

Procedure: If all answers are **No**, follow the test planning guide instructions to include the appropriate statement in the test plan. If any answer is **Yes** or **Don't Know**, call AFFTC/EMXC at 7-1401 for consultation and resolution.

Does the action...

Yes	No	Don't Know		
☐	☐	☐	1.	involve any construction or remodeling of buildings?
☐	☐	☐	2.	involve installing of trailers?
☐	☐	☐	3.	vent any gas, liquid, or objectionable odor into the air **other than normal engine exhaust** (normal engine exhaust for us is from aircraft, AGE, GSE, APU, or HVAC systems)?
☐	☐	☐	4.	expose people to potential health hazards that are **not part of normal test** operations, such as a new type of fuel, laser, explosive device, or insulating material?
☐	☐	☐	5.	use radioactive materials or toxic substances (toxic here means something different than jet gas, hydraulic fluid etc. that are normally involved in test operations)?
☐	☐	☐	6.	generate or store hazardous materials or waste?
☐	☐	☐	7.	require AFFTC to receive and operate new AGE, GSE or portable electric power generators that are $\geq$ 50 BHP?

ENVIRONMENTAL CHECKLIST FOR AFFTC DEVELOPMENTAL, OPERATIONAL, OR FOLLOW-ON TEST & EVALUATION ACTIVITIES (Concluded)

Does the action...

Yes	No	Don't Know	
☐	☐	☐	8. increase ground noise levels above existing levels at the test location (e.g., taking an F-15 to do afterburner takeoffs to an airfield that normally only has A-10's flying out of it)?
☐	☐	☐	9. deliberately jettison any object, liquid, or gas from the aircraft?
☐	☐	☐	10. involve an FAA request to establish or modify special use airspace?
☐	☐	☐	11. alter existing air traffic patterns?
☐	☐	☐	12. use unique low-level routes and not the FAA-published low-level military training routes or the AFFTC colored routes?
☐	☐	☐	13. require flight outside the R-2508 Complex of special use airspace?
☐	☐	☐	14. require low-level (below 3,000 feet AGL) flight outside FAA-approved low level areas, MOAs, or routes?
☐	☐	☐	15. require supersonic flight outside FAA-approved supersonic operating areas?

APPENDIX E

AIRCRAFT PERFORMANCE INCLUDING AIR DATA

This appendix is reserved for test planning guidance that is applicable to aircraft performance testing including air data systems, and provides references and pertinent information that is not included in a published document.

References that may be useful in planning performance tests include:

1. Herrington, et al., *Flight Test Engineering Handbook*, AF Technical Report No. 6273, AFFTC, Edwards AFB, California, January 1966. (Outdated in many aspects but contains useful tables on air data and the atmosphere, and theoretical discussions on aircraft performance.)

2. *Introduction to Flight Test Engineering, Airdata Measurement and Calibration*, Section 11, pages 1-17, AGARD Flight Test Techniques Series, Volume 14, September 1995.

3. *Introduction to Flight Test Engineering, Performance*, Section 13, pages 1-15, AGARD Flight Test Techniques Series, Volume 14, September 1995.

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APPENDIX F

STABILITY AND CONTROL, FLIGHT CONTROLS, AND FLYING QUALITIES

This appendix is reserved for test planning guidance that is applicable to stability and control, flight controls, and flying qualities, and provides references and pertinent information that is not included in a published document.

References that may be useful in planning stability and control, flight controls, and flying qualities tests include:

1. *Introduction to Flight Test Engineering*, Handling Qualities, Section 15, pages 1-17, AGARD Flight Test Techniques Series, Volume 14, September 1995.

AFFTC STANDARD HANDLING QUALITIES DURING AERIAL REFUELING PLANNING AND DEBRIEFING GUIDE

10 Feb 98

The following guide should be used in evaluating the handling qualities of aircraft in aerial refueling. If any question is obviously not applicable to your test it may be ignored.

Handling-qualities-during-refueling tests should be conducted in cooperation with the fuel systems (Systems Integration Division) engineers. The handbook, **Lush, Kenneth J.,** ***Fuel Subsystems Flight Test Handbook*****, AFFTC-TIH-81-6, December 1981, U.S. Air Force, Edwards AFB, California,** should be reviewed. The fuel-subsystems engineers also have a standardized test tracking sheet for planning and recording each maneuver behind the tanker which should also be reviewed and used as appropriate.

Testing at the full range of **both** receiver and tanker weights should be considered. The magnitude of the downwash may change significantly between heavy and lightweights. Some uncomfortable attitudes (very nose-up or nose-down) may also occur at extremes of weight.

From a handling qualities standpoint the important characteristic is to be able to stabilize the aircraft and keep them in close formation with the receiver in a variety of positions behind the tanker.

1. The first task is defined as stabilizing the refueling aircraft in the precontact position. Using the Cooper-Harper Rating Scale rate your ability to stabilize the aircraft in the precontact position.

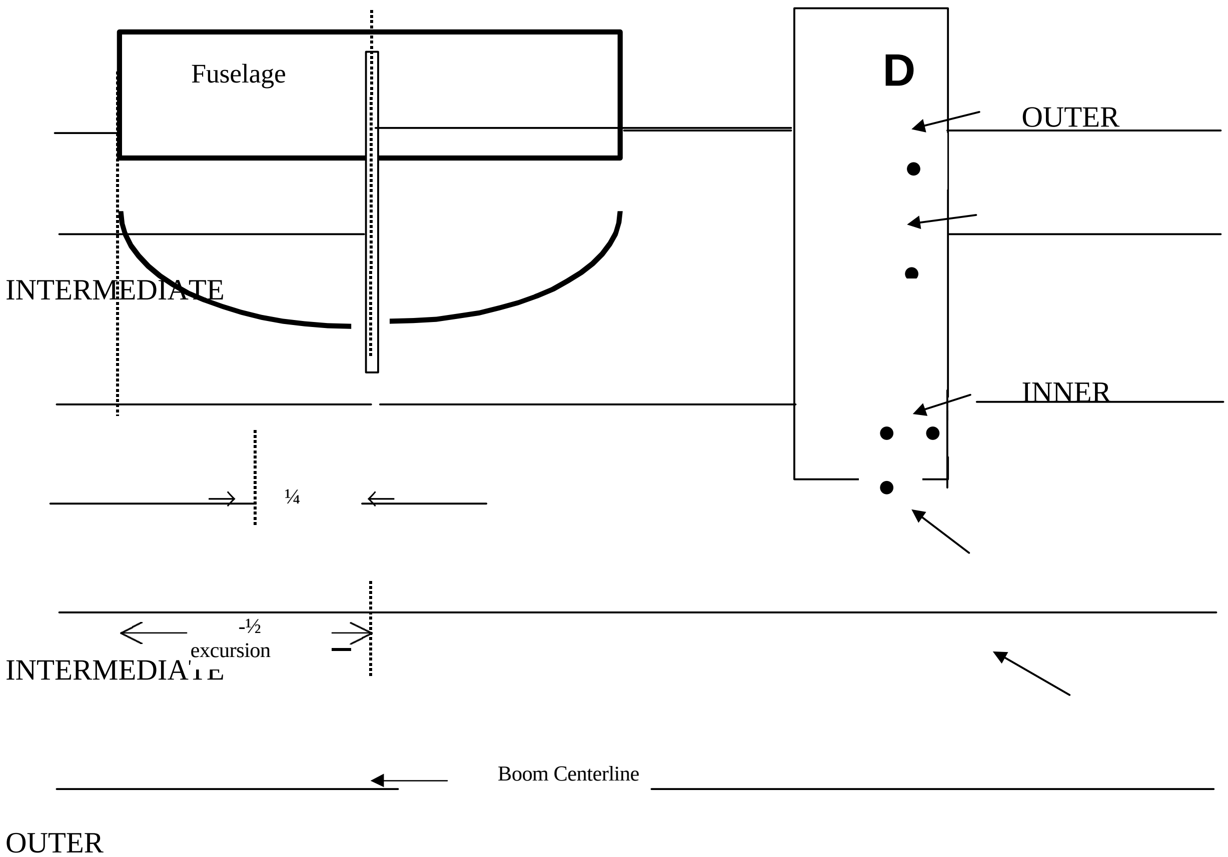
2. The second task is defined as moving from the precontact position to the contact position. Using the Cooper-Harper Rating Scale rate your ability to maneuver the aircraft from the precontact position to the contact position.

3. The third task is defined as stabilizing the receiving aircraft in the contact position (straight-and-level flight).

   (a) Answer this question for each contact position (various positions within the boom's envelope, or drogue's envelope). Using the Cooper-Harper Rating Scale, rate your ability to stabilize the aircraft in the contact position.

4. The fourth task: answer 3(a) for turning flight.

5. The fifth task is to maintain the aircraft within the boom envelope such that the center most pilot director lights (captains bars) are illuminated for 10 minutes continuously. See diagram below.



Cockpit View of Tanker Fuselage

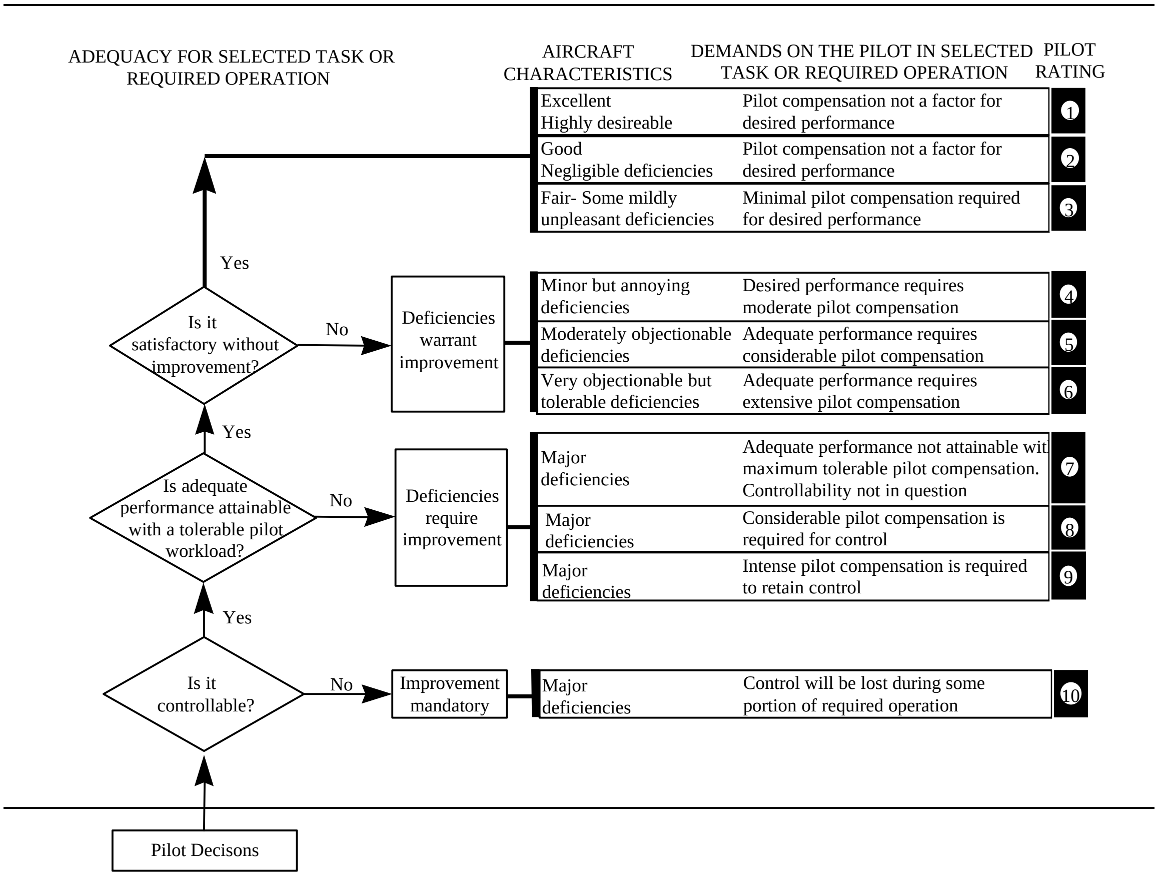
Pilot Director Lights (Typical)

Definitions for Cooper-Harper performance criteria are as follows:

ADEQUATE performance in elevation and boom extension is defined as flying the aircraft such that the following light combinations are observed (see figure below): steady inner lights, steady intermediate lights, or a short duration time interval of intermediate, and outer lights which prompt the pilot to return to the center. Adequate azimuth performance is defined as keeping the excursions in tanker image within ±½-fuselage image width (see figure). A maximum of two disconnects are allowed.

DESIRED performance in elevation and boom extension is defined as flying the aircraft such that only the following light combinations are observed: steady inner lights or a short duration time interval of inner lights and intermediate lights that prompt the pilot to return to the center. Desired azimuth performance is defined as keeping the excursions in tanker image within ±¼-fuselage image width. No disconnects are allowed.

COOPER-HARPER RATING SCALE



Program Title: ______________________________

Name: ______________ Organization: ______________ Phone: ______________

Date of Flight: ______________ A/C Type: ______________ Tail No. ______________

Altitude (ft): ______________

Airspeed (KIAS): ______________

Receiver Gross Weight (lbs)/CG (%): ______________

Free-Air Turbulence: _____ Light _____ Moderate _____ Severe

Distance Aft of Tanker (ft)	Test Position/Maneuver	Power Setting (%)	Trim Input			Tendencies			Tanker Wake/Engine Turbulence		HQR – Comments (Throttle Response, etc.)
			Pitch	Roll	Yaw	Pitc h	Roll	Yaw	Frequency	Intensity	

Test Position (Stabilized):

E - Boom Elevation (Degrees)
R - Boom Right Azimuth (Degrees)
L - Boom Left Azimuth (Degrees)
0 - Boom Zero Azimuth (Degrees)

Tendencies:

SM - Slight Moment
MM - Moderate Moment
LM - Large Moment
N - Nose

Tanker Wake/Engine Turbulence:

Frequency
O - Occasional
I - Intermittent
C - Continuous

Intensity
Lt - Light
Mod - Moderate
Sev - Severe

Boom Tracking: Receiver nose follows boom nozzle as boom is flow in a box pattern around the limits of the receiver’s boom envelope.

Use the following questions to describe any noteworthy characteristics. For questions 6 through 12(a), **each axis (fore-aft, azimuth, and elevation)** should be considered separately, if appropriate.

6. Was wake turbulence encountered?

(a) If so, where and how severe?

(b) Were there any obvious effects of the tanker on the receiver (e.g., tanker engine exhaust impinging on the receiver's tail or wing)?

7. Were there any uncomfortable attitudes experienced (e.g., extreme nose-up or nose-down)?

(a). If so, what, where and why?

8. Was the aircraft response predictable?

(a) If not, how did the unpredictability affect your workload or ability to conduct the task?

9. Was the aircraft response desirable, overly sensitive, or sluggish?

(a) If sluggish or sensitive how did it affect your workload or ability to conduct the task?

10. Were there any perceptible time delays in any axis, including throttle response?

(a) If so, how did it affect your workload or ability to conduct the task?

11. Were there any oscillations, overshoots or PIO tendencies?

(a) If so, how did they affect your workload or ability to conduct the task

12. Were control forces desirable, too light, or too heavy?

(a) If so, how did they affect your workload or ability to conduct the task?

13. Were there any unplanned disconnects?

(a). If so, how many and why?

14. Was your view of the tanker and visual cues adequate? (Note you may want to answer this question for **day, night and various weather** conditions.)

(a) If not, why?

(b) If not, how did they affect your workload or ability to conduct the task?

If you are:

1. testing a modification to an aircraft that was previously aerial refueling certified,

2. testing a variety of gains, autopilot modes, control system software, cockpit displays, etc., or

3. certifying the receiver behind a new tanker,

use the following questions to compare the 'new' situation to some 'old' baseline. Use the AFFTC standard scale for comparisons which is: 5 = much better, 4 = better, 3 = about the same, 2 = worse, 1 = much worse. (See pages 38-42 of AFFTC TIH 97-01, *Writing AFFTC Technical Reports* (Reference 12), for a discussion of AFFTC standard scales.)

15. How did this version of ____________________ (*control system, gains, cockpit displays, etc. fill in as appropriate*) compare with the baseline version?

16. How did flying behind the ______________ (*fill in tanker type*) compare to flying behind the ______________ (*fill in baseline tanker type*)?

Summary questions for receiver aircraft.

17. Are there any desired enhancements that need consideration for follow-on development?

(a) If so, what and why ?

18. From a handling qualities standpoint should the receiver aircraft, in the configuration tested, be released for aerial refueling to the using command(s)?

(a) If not, why?

19. Are there any notes, cautions, warnings, or noteworthy information that the users should be aware of concerning handling qualities during aerial refueling of this aircraft?

(a) If so, what are they?

The following questions apply to the tanker aircraft.

20. Were there any noticeable effects of the receiver on the tanker aircraft?

(a) If so, describe them. What axis, how severe, and corrective action (e.g., trim changes, more or less throttle required, etc.).

APPENDIX G

HUMAN FACTORS

This appendix is reserved for test planning guidance that is applicable to human factors testing and provides references and pertinent information that is not included in a published document.

References that may be useful in planning human factors tests include:

1. *Introduction to Flight Test Engineering*, Human Factors, Section 20, pages 1-18, AGARD Flight Test Techniques Series, Volume 14, September 1995.

2. *Guide to Human Performance Measurements*, ANSI/AIAA G-035-1992, American National Standard, 9 July 1993.

3. Babbit, Bettina A., and Nystrom, Charles O., *Questionnaire Construction Manual*, ARI Research Product 89-20, US Army Research Institute for the Behavioral and Social Sciences, Ft. Hood, Texas, revised June 1989.

4. Van Cott, Harold P., and Kinkade, Robert G., eds., *Human Engineering Guide to Equipment Design*, U.S. Government Printing Office, Washington DC, 1972.

5. Boff, Kenneth R., and Lincoln, Janet E., eds., *Engineering Data Compendium*, Harry G. Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB, Ohio, 1988.

6. Boff, Kenneth R., Kaufman, Lloyd, and Thomas, James P., eds., *Handbook of Perception and Human Performance*, John Wiley and Sons, New York City, New York, 1986.

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APPENDIX H

RELIABILITY AND MAINTAINABILITY

This appendix is reserved for test planning guidance that is applicable to reliability and maintainability and provides references and pertinent information that is not included in a published document.

References that may be useful in planning reliability and maintainability tests include:

1. AFFTCI 99-4, *Flight Test Center Deficiency Reporting*, 26 May 1998.

2. *Reliability and Maintainability*, AGARD Flight Test Techniques Series, Volume 13, February 1995.

3. *Introduction to Flight Test Engineering, Reliability and Maintainability*, Section 22, pages 1-9, AGARD Flight Test Techniques Series, Volume 14, September 1995.

4. Kececioglu, Dimitri, Dr, *Reliability Engineering Handbook*, Prentice-Hal Inc., Volumes 1 & 2, Upper Saddle River, New Jersey, 1991.

5. *Reliability Engineer's Toolkit*, The Rome Laboratory, Air Force Material Command, Griffiss AFB, New York, April 1993.

6. Blanchard, Benjamin S. and Fabrycky, Wolter J., *Systems Engineering and Analysis*, 3rd Edition, ed. W.J. Fabrycky and J.H. Mize, Prentice-Hall Inc., Upper Saddle River, New Jersey, 1998.

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APPENDIX I

LOGISTICS

This appendix is reserved for test planning guidance that is applicable to logistic testing and provides references and pertinent information that is not included in a published document.

References that may be useful in planning logistic tests include:

1. *Logistics Test and Evaluation Handbook*, Rev.1, 412 Logistics Test Group, AFFTC, Edwards AFB, California, March 1997.

2. *Introduction to Flight Test Engineering, Logistics Test and Evaluation*, Section 23, pages 1-9, AGARD Flight Test Techniques Series, Volume 14, September 1995.

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APPENDIX J

ARMAMENT

This appendix is reserved for test planning guidance that is applicable to armament testing and provides references and pertinent information that is not included in a published document.

References that may be useful in planning armament tests include:

1. *Introduction to Flight Test Engineering, Armament Testing and Stores Separation*, Section 25, pages 1-5, AGARD Flight Test Techniques Series, Volume 14, September 1995.

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APPENDIX K

AVIONICS

This appendix is reserved for test planning guidance that is applicable to avionics testing and provides references and pertinent information that is not included in a published document.

References that may be useful in planning avionics tests include:

1. Scott, Randall E., *Air-to-Air Radar Flight Test Handbook*, AFFTC-TIH-87-001, AFFTC, Edwards AFB, California, October 1987.

2. *Introduction to Flight Test Engineering*, *Avionics*, Section 21, pages 1-15, AGARD Flight Test Techniques Series, Volume 14, September 1995.

3. *Introduction to Flight Test Engineering*, *Antenna Radiation Patterns*, Section 19B, pages 1-21, AGARD Flight Test Techniques Series, Volume 14, September 1995.

4. *Introduction to Flight Test Engineering*, *Electromagnetic Compatibility*, Section 27, pages 1-15, AGARD Flight Test Techniques Series, Volume 14, September 1995.

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APPENDIX L

ELECTRONIC WARFARE

This appendix is reserved for test planning guidance that is applicable to electronic warfare testing and provides references and pertinent information that is not included in a published document.

References that may be useful in planning electronic warfare tests include:

1. *Electronic Warfare and Radar Systems Engineering Handbook*, Naval Air Warfare Center, Weapons Division, Point Mugu, California, March 1992.

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APPENDIX M

SUBSYSTEMS

This appendix is reserved for test planning guidance that is applicable to aircraft subsystems testing and provides references and pertinent information that is not included in a published document.

References that may be useful in planning aircraft subsystems tests include:

1. Hendrickson, Clendon L., *Flight Testing Under Extreme Climatic Conditions*, AFFTC TIH-88-004, September 1988.

2. Lush, Kenneth J., *Electrical Subsystems Flight Test Handbook*, AFFTC TIH 84-1, January 1984.

3. Lush, Kenneth J., *Environmental Control Subsystems*, AFFTC TIH 82-1, December 1982.

4. Lush, Kenneth J., *Fuel Subsystems Flight Test Handbook*, AFFTC TIH 81-6, December 1981.

5. Lush, Kenneth J., *Hydraulic Subsystems Flight Test Handbook*, AFFTC TIH 83-2, August 1983.

6. Mandt, Gregory A. and Plews, Larry D., *Aircraft Brake Systems Testing Handbook*, AFFTC TIH 81-1, May 1981.

7. Tracy, William V., Jr., *Aircraft Arresting Gear Testing*, AFFTC, Edwards AFB, California, not dated.

8. Tracy, William V., Jr., *Engine Inlet/Nose Tire Water Ingestion, Vol II*, Chap V, Section II, Part II, AFFTC, Edwards AFB, California, September 1979.

9. Tracy, William V., Jr., *Landing Gear Subsystem Testing*, AFFTC, Edwards AFB, California, not dated.

10. Tracy, William V., Jr., *Natural and Artificial Icing/Rain Testing, Vol II*, Chap V, Section II, Part I, AFFTC, Edwards AFB, California, January 1980.

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APPENDIX N

AERIAL DELIVERY

This appendix is reserved for test planning guidance applicable to aerial delivery testing and provides references and pertinent information that is not included in a published document.

References that may be useful in planning aerial delivery tests include:

1. *Criteria for Nonstandard Airdrop Loads*, ASD-TM-ENE-77-1, Change 2, December 1983.

2. Knacke, T.W., *Parachute Recovery Systems Design Manual*, Para Publishing, 1992.

3. Hunter, Henry J., *Developmental Airdrop Testing Techniques and Devices*, AGARD-AG-300, Vol. 6, 1987.

4. Ewing, E.G., Bixby, H. W., Knacke, T.W., *Recovery Systems Design Guide*, AFFDL-TR-78-151, AFFDL, Wright-Patterson AFB, Ohio, September 1978.

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MASTER LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS

(Abbreviations marked with an asterisk are regarded as in common use and need not be defined when first used in a test plan.)

Abbreviation	Definition	Units
AAA	anti-aircraft artillery	---
AAC	Air Armament Center	---
A/A	air-to-air	---
AAM	air-to-air missile	---
A/B	afterburner	---
ABM	antiballistic missile	---
A/C	aircraft	---
ACAL	altitude calibration	---
ACBT	air combat training	---
ACC	Air Combat Command; avionic computer complex	---
ACES	advanced concept ejection seat	---
ACETEF	Air Combat Environment Test and Evaluation Facility	---
ACIU	advanced central interface unit	---
ACL	air recirculation coolant loop	---
ACM	air combat mode	---
ACM	air combat maneuvering	---
ACMI	air combat maneuvering instrumentation	---
ACQ	acquisition	---
ACU	antenna control unit	---
AD	Armament Division	---
ADA	advanced computer programming language	---
ADF	automatic direction finder	---
ADG	accessory drive gearbox	---
ADI	attitude director indicator	---
ADLAT	advanced low-altitude terrain	---
ADP	automated data processing	---
ADPO	Advanced Development Program Office	---
ADS	accessory drive system; air data system; aerial delivery system	---
ADV	adverse	---
AE	antenna electronics	---

MASTER LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

Abbreviation	Definition	Units
AEDC	Arnold Engineering Development Center	---
AEW	advanced early warning	---
AF	Air Force	---
AFAAMRL	Air Force Armstrong Aerospace Medical Research Laboratory	---
*AFB	Air Force Base	---
AFCC	Air Force Communications Command	---
AFCS	automatic flight control system	---
AFEWES	Air Force Electronic Warfare Evaluation Simulator	---
AFFDL	Air Force Flight Dynamics Laboratory	---
AFDTC	Air Force Development Test Center	---
AFFTC	Air Force Flight Test Center	---
AFFTCI	Air Force Flight Test Center Instruction	---
AFHRL	Air Force Human Resources Laboratory	---
*AFI	Air Force Instruction	---
*AFLC	Air Force Logistics Command	---
*AFMAN	Air Force Manual	---
AFMC	Air Force Materiel Command	---
AFMCM	Air Force Materiel Command Manual	---
AFMCR	Air Force Materiel Command Regulation	---
*AFOTEC	Air Force Operational Test & Evaluation Center	---
*AFR	Air Force Regulation	---
AFTO	Air Force Technical Order	---
*AFSC	Air Force Systems Command	---
*AFSCM	Air Force Systems Command Manual	---
*AFSCR	Air Force System Command Regulation	---
AFWAL	Air Force Wright Aeronautical Laboratories	---
AFWL	Air Force Weapons Laboratory	---
A/G	air-to-ground	---
AGARD	Advisory Group for Aeronautical Research and Development	---
AGC	automatic gain control	---
*AGL	above ground level	---

MASTER LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

Abbreviation	Definition	Units
AGM	air-to-ground missile	---
AGR	air-to-ground ranging	---
AGTS	Aerial Gunnery Target System	---
AHRS	attitude heading reference system	---
AI	artificial intelligence	---
AIBU	advanced interface blanker unit	---
AICS	automatic inlet control system	---
AIFF	automatic identification friend or foe	---
AIL	avionic integration laboratory	---
AILA	airborne instrument landing approach	---
AIM	air intercept missile	---
AIS	airborne instrumentation subsystem	---
AITF	avionic integrated test facility	---
AIU	avionic integration unit	---
AJ	antijam	---
ALBIT	all built-in test	---
ALC	Air Logistics Center	---
ALCM	air launched cruise missile	---
ALOW	altitude low; allowance	---
ALT	altitude	---
ALTB	altitude banker	---
*AM	amplitude modulation	---
AMAC	aircraft monitor and control	---
AMAD	aircraft mounted accessory drive	---
AMC	Air Mobility Command	---
AMRAAM	advanced medium range air-to-air missile	---
AMS	advanced mode switch	---
AND	aircraft nose down	---
ANL	aircraft nose left	---
ANR	aircraft nose right	---
ANSI	American National Standard Institute	---
ANU	aircraft nose up	---
AOA	angle of attack; angle of arrival	deg/units

MASTER LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

Abbreviation	Definition	Units
AOS	angle of sideslip	deg
AP	autopilot	---
*APU	auxiliary power unit	---
A/R	as required	---
AR	air-to-air refueling; aspect ratio	---
ARB	aerial refueling boom	---
ARI	aileron-rudder-interconnect	---
ARIA	airborne range instrumentation aircraft	---
ARM	antiradiation missile	---
ARM	master arm switch in ARM position	---
ARTCC	Air Route Traffic Control Center	---
ARWR	advanced radar warning receiver	---
A/S	airspeed	kt
*ASC	Aeronautical Systems Center	---
ASC	attack steering cue	---
*ASCII	American Standard Code for Information Interchange	---
ASD/YPT	Aeronautical systems Division F-16 System Program Office	---
ASE	allowable steering error	---
ASIP	aircraft structural integrity program	---
ASLAR	aircraft surge launch and recovery	---
ASM	air-to-surface missile	---
ASRC	active seeker range cue	---
ASW	antisubmarine warfare	---
AS3	avionic system segment specification	---
*ATC	Air Training Command	---
ATE	automated test equipment	---
ATIS	airborne test instrumentation system	---
ATS	air turbine starter	---
ATT	attitude	---
AUTO	automatic	---
AUX	auxiliary	---

MASTER LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

Abbreviation	Definition	Units
AVGAS	aviation gas	---
AVTR	airborne videotape recorder	---
*AWACS	airborne warning and control system	---
AWS	advanced warning system	---
AZ	azimuth	---
a	speed of sound	ft per sec
*ac	alternating current	---
a.c.	aerodynamic center	---
accel	acceleration	---
a_f	acceleration factor	dimensionless
a_I	inertial acceleration	ft per sec^2
alt	altitude	ft
*amp	amperes	---
assy	assembly	---
aux	auxiliary	---
*avg	average	---
a	acceleration along body axis (longitudinal)	ft per sec^2
a_{x_s}	acceleration along stability x-axis	ft per sec^2
a_{x_w}	acceleration along wind x-axis (flightpath)	ft per sec^2
a_{y_b}	acceleration along body y-axis (flightpath)	ft per sec^2
a_{y_s}	acceleration along stability y-axis	ft per sec^2
a_{y_w}	acceleration along wind y-axis	ft per sec^2
a_{z_b}	acceleration along body z-axis	ft per sec^2
a_{z_s}	acceleration along stability z-axis	ft per sec^2
a_{z_w}	acceleration along wind z-axis	ft per sec^2
BAF	Benefield Anechoic Facility	---
BARO	barometric	---
*BASIC	beginner's all-purpose symbolic instruction code	---
BASS	bombing analysis software system	---
BATR	bullets at target range	---
BATT	battery	---

MASTER LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

Abbreviation	Definition	Units
BCD	binary coded decimal	---
BCN	beacon	---
BDA	bomb damage assessment	---
BDHI	bearing distance heading indicator	---
BDU	bomb dummy unit	---
BET	best estimate of trajectory	---
BFM	basic fighter maneuver	---
BHOT	black hot	---
BIT	built-in test	---
BITE	built-in-test equipment	---
BL	aircraft buttock line	---
BLC	boundary layer control	---
BMEWS	ballistic missile early warning system	---
BNS	bomb, navigation system	---
BORAM	block oriented random access memory	---
BORE	boresight	---
BRG	bearing	---
BRT	brightness	---
BSU	bomb shape unit	---
BUP	backup	---
BVR	beyond visual range	---
BW	beam width; bandwidth	---
Btu	British thermal unit	---
b	wingspan	ft
bend.	bending	---
b_s	breaking strength	---
C	centerline	---
*C	Centigrade or Celsius	deg
CAD	computer aided design	---
CADC	central air data computer	---
CADD/CAM	computer aided design drafting/computer aided manufacturing	---
CAI	computer aided instruction	---

MASTER LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

Abbreviation	Definition	Units
CAL	calibrate	---
CAR	Civil Air Regulation	---
CARA	combined altitude radar altimeter	---
CAS	calibrated airspeed	kt
CAS	control augmentation system	---
CAT	category	---
CBR	California bearing ratio; chemical/biological/ radiological	---
CBU	cluster bomb unit	---
CBW	constant bandwidth; chemical-biological warfare	---
CCB	configuration control board	---
CCD	charge couple device	---
CCIP	continuously computed impact point	---
CCP	contract change proposal	---
CCRP	continuously computed release point	---
CCU	cockpit control unit	---
CCW	counterclockwise	---
CD	chemical defense	---
CDPCO	command destruct power changeover	---
CDR	critical design review	---
CDRL	contract data requirements list	---
CDP	compressor discharge pressure	---
CDS	container delivery system	---
CDU	controls and displays unit	---
C-E	communications-electronics	---
CEA	circular error average	---
CEI	contract end item	---
CEP	circular error probable	---
CEU	central electronic unit	---
CFAE	contractor furnished aerospace equipment	---
CFE	contractor furnished equipment	---
CFIT	control flight into terrain	---
CFOV	center field of view	---

MASTER LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

Abbreviation	Definition	Units
CGB	central gearbox	---
CHAN	channel	---
CH	Cooper-Harper rating	---
CIDS	configuration item development specification	---
CIGTF	central inertial guidance test facility	---
*CINC	Commander-In-Chief	---
CINE-T	cinetheodolite	---
CIP	component improvement program	---
CIRIS	completely integrated reference instrumentation system	---
CLR	clear	---
CMDS	countermeasures dispensing set	---
CMD STRG	command steering	---
CMS	countermeasure management switch	---
C/N	counter number	---
CNI	communications/navigation/identification	---
CNTL	control	---
*COBOL	common business oriented language	---
COH	cold-on-hot	---
COI	critical operational issue	---
COIN	counterinsurgency	---
COM1	communication set 1, UHF radio	---
COM2	communication set 2, VHF radio	---
COMM	communication	---
*COMSEC	communications security	---
CON	contrast	---
*Conus	Continental United States	---
CONV	conventional	---
CPB	critical point selection	---
CPR	compressor pressure ratio	---
CPU	central processing unit	---
CRPA	controlled reception pattern antenna	---
CRS	course	---

MASTER LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

Abbreviation	Definition	Units
*CRT	cathode ray tube	---
CRUS TOS	cruise time-over steerpoint	---
*CSAF	Chief of Staff Air Force	---
CSD	constant speed drive	---
CSFDR	crash survivable flight data recorder	---
CSS	control stick steering	---
CTF	combined test force	---
CW	chemical warfare; continuous wave	---
*CY	calendar year	---
CZ	cursor zero	---
C_{D}	aircraft total drag coefficient	dimensionless
C_{D_a}	additive drag coefficient	dimensionless
C_{D_b}	base drag coefficient	dimensionless
C_{D_e}	effective parasite drag coefficient	dimensionless
C_{D_i}	induced drag coefficient	dimensionless
$C_{D_{\min}}$	minimum drag coefficient	dimensionless
C_{D_o}	zero lift drag coefficient	dimensionless
C_{D_a}	$\partial CD/\partial\alpha$	per deg
$C_{D_{de}}$	$\partial CD\partial\delta e$	per deg
C_{L}	lift coefficient	dimensionless
C_{L_q}	$\partial CL/\partial(qc/2V)$	dimensionless
C_{L_a}	$\partial CL/\partial\alpha$	per deg
$C_{L_{de}}$	$\partial CL/\partial\delta e$	per deg
$C_{L_{ds}}$	$\partial CL/\partial\delta s$	per deg
C_{N}	normal force coefficient	dimensionless
C_{N_o}	normal force coefficient bias	dimensionless
C_{N_v}	$V/2\ (\partial CN/\partial V)$	dimensionless
C_{N_a}	$\partial CN/\partial\alpha$	per deg
$C_{N_{de}}$	$\partial CN/\partial\delta e$	per deg

MASTER LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

Abbreviation	Definition	Units
C_T	thrust coefficient	dimensionless
C_c	chord force coefficient	dimensionless
C_f	gross thrust coefficient	dimensionless
C_l	rolling moment coefficient	dimensionless
C_{l_p}	∂Cl/∂(pb/2V)	per deg
C_{l_r}	∂Cl/∂(rb/2V)	per deg
C_{l_b}	∂Cl/∂β	per deg
$C_{l_{da}}$	∂Cl/∂δa	per deg
$C_{l_{dr}}$	∂Cl/∂δr	per deg
C_m	pitching moment coefficient	dimensionless
C_{m_o}	pitching moment coefficient at zero AOA	dimensionless
C_{m_a}	∂Cm/∂α	per deg
$C_{m_{de}}$	∂Cm/∂δe	per deg
C_{m_q}	∂Cm/∂(qc/2V)	dimensionless
C_n	yawing moment coefficient	dimensionless
C_{n_p}	∂Cn/∂(pb/2V)	per deg
C_{n_r}	∂Cn/∂(rb/2V)	per deg
C_{n_b}	∂Cn/∂β	per deg
$C_{n_{*b}}$	dynamic directional stability	per deg
$C_{n_{da}}$	∂Cn/∂δa	per deg
$C_{n_{dr}}$	∂Cn/∂δr	per deg
C_p	pressure coefficient	dimensionless
C_y	side-force coefficient	dimensionless
C_{y_p}	∂Cy/∂(Pb/2V)	per deg
C_{y_r}	∂Cy/∂(Rb/2V)	per deg
C_{y_b}	∂Cy/∂β	per deg

MASTER LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

Abbreviation	Definition	Units
$C_{y_{da}}$	$\partial Cy/\partial \delta a$	per deg
$C_{y_{dr}}$	$\partial Cy/\partial \delta r$	per deg
$C_{1/2}$	number of cycles to damp to half amplitude	---
$C_{1/10}$	number of cycles to damp to one-tenth amplitude	---
c	wing chord	ft
c	length of the mean aerodynamic chord	ft
*cc	cubic centimeters	---
*cg	center of gravity	pct MAC
cm	centimeters	---
ccntr	counter	---
*comm	communications	---
D	drag	lb
DAGRAG	dual air-to-ground gunnery and bombing range	---
DARPA	Defense Advanced Research Projects Agency	---
DATS	data acquisition and transmission system	---
DB	dry bulb temperature	deg
DBAL	delta ballistics (delta bomb range)	---
DBIU	database interface unit	---
DBS	Doppler beam sharpening	---
DCLT	declutter	---
DCS	Deputy Chief of Staff	---
DCM	defensive combat maneuvering	---
DEC	decrement	---
DED	data entry display	---
DEEC	digital electronic engine control	---
DEEU	data entry electronics unit	---
DEFCON	defense condition	---
DEGR	degrade	---
DEP	design eye position	---
DEST	destination	---
DF	direction finder	---

MASTER LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

Abbreviation	Definition	Units
DFP	display function processor	---
DFLCS	digital flight control system	---
DFRC	Dryden Flight Research Center	---
DG	directional gyro	---
DGFT	dogfight	---
DI	Doppler inertial	---
DLL	design load limit	---
DLZ	dynamic launch zone; designated launch zone	---
DMA	direct memory access; Defense Mapping Agency	---
*DME	distance measuring equipment	---
DMS	display management switch	---
DMT	dual mode transmitter	---
DOB	defensive order of battle	---
*DoD	Department of Defense	---
*DoE	Department of Energy	---
DPG	Dugway Proving Grounds	---
DPLR	Doppler	---
DPS	digital performance simulation	---
DR	dead reckoning; deficiency report	---
D/R	decoder/receiver	---
DSC	digital scan converter	---
DSO	defensive systems operator	---
DTC	data transfer cartridge	---
DTE	data transfer equipment	---
*DT&E	development test and evaluation	---
DTIC	Defense Technical Information Center	---
DTIS	detailed test information sheet	---
DTOS	dive toss	---
DTP	detailed test plan	---
DVS	Doppler velocity sensor	---
DZ	drop zone	---
D_o	nominal parachute diameter	ft

MASTER LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

Abbreviation	Definition	Units
D_p	parasite drag	lb
D_w	wave drag	lb
d	diameter	ft
d	differential	---
d/a	digital to analog	---
dB	decibel	---
dBm	decibel referenced to milliwatts	---
*dc	direct current	---
decel	deceleration	---
*deg	degree(s)	---
dim.	dimensions	---
d/dt	time rate of change	---
E	total energy	ft-lb
E^2	expanded exponential	---
EA	electronic attack	---
EAFB	Edwards Air Force Base	---
EAS	equivalent airspeed	kt
EAS	electronic altitude sensor	---
EBP	exhaust back pressure	in. Hg
ECA	electronic component assembly	---
*ECCM	electronic counter-countermeasures	---
ECG	electrocardiogram	---
ECIU	enhanced central interface unit	---
*ECM	electronic countermeasures	---
ECO	engineering change order	---
ECP	engineering change proposal	---
ECS	environmental control system	---
ECU	electronic control unit	---
EEC	electronic engine control	---
EEG	electroencephalogram	---
EEGS	enhanced envelope gunsight	---

Abbreviation	Definition	Units
EEPROM	electronically erasable programmable read only memory	---
EFCC	enhanced fire control computer	---
EGT	exhaust gas temperature	deg
EHE	expected horizontal error	---
EHF	extremely high frequency	---
EHSI	electronic horizontal situation indicator	---
EIA	enhanced interrupted alignment	---
EJ	emergency jettison	---
EL	electro-luminescent	---
*ELINT	electronic intelligence	---
EMC	electromagnetic compatibility	---
EMG	electromyogram	---
*EMI	electromagnetic interference	---
EMP	electromagnetic pulse	---
EO	electro-optical; engineering order	---
EOB	electronic order of battle	---
EOG	electro-oculogram	---
EO-PRE	electro-optical preplanned	---
EO-VIS	electro-optical visual	---
EPR	engine pressure ratio	---
EPU	emergency power unit	---
ERP	effective radiated power	---
*ESC	Electronic Systems Center	---
*ETA	estimated time of arrival	---
*ETD	estimated time of departure	---
ETSS	Engineering and Technical Support Services	---
EU	engineering unit(s)	---
EVE	expected vertical error	---
EW	electronic warfare	---
E/W	specific energy	ft
EWAISE	Electronic Warfare Avionic Integration Support Facility	---
EWO	electronic warfare officer; emergency war order	---

MASTER LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

Abbreviation	Definition	Units
EXP	expand	---
e	aircraft efficiency factor	dimensionless
el	elevation	ft
eng	engine	---
ext	external	---
*F	Fahrenheit	deg
*FAA	Federal Aviation Administration	---
FAC	forward air controller	---
FAR	false alarm rate; Federal Air Regulation	---
FAT	free air temperature	deg
FBW	fly-by-wire	---
FCC	fire control computer	---
FCF	functional check flight	---
FCR	fire control radar	---
FCS	flight control system	---
FDBK	feedback	---
FDP	fatigue decreased proficiency	---
FE	flight engineer	---
FEBA	forward edge of the battle area	---
FFAR	folding-fin aircraft rocket	---
FINS	fixed imaging navigation set	---
FIT	fault isolation technique	---
FIX	fix taking	---
FLCS	flight control system	---
*FLIR	forward looking infrared	---
FLR	forward looking radar	---
FLTS	Flight Test Squadron	---
FLUP	fly up	---
*FM	frequency modulation	---
FOC	fiber optic cable; full operational capability	---
FOR	field of regard	---
*FORTRAN	FORmula TRANslation	---
FOT&E	follow-on test and evaluation	---

MASTER LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

Abbreviation	Definition	Units
FOV	field of view	---
FR	rocket engine thrust	lb
FP	flightpath	---
FPA	flightpath accelerometer	---
FPM	flightpath marker	---
FRL	fuselage reference line	in
FS	fuselage station	---
FSED	full-scale engineering development	---
*FSN	federal stock number	---
FTD	Foreign Technology Division	---
FTI	flight test instrumentation	---
FTMCC	flight test mission control center	---
FTT	fixed-target track	---
FTWO	flight test work order	---
FU	fuel used	lb
FVL	flight vector line	---
FWD	forward	---
*FY	fiscal year	---
F_a	lateral control force	dimensionless
F_e	longitudinal control force	dimensionless
F_e	propulsive drag	lb
F_{ex}	excess thrust	lb
F_g	gross thrust	lb
F_n	net thrust	lb
F_r	rudder pedal force, ram drag	lb
f	frequency	Hz
fL	foot-lambert	---
fc	foot-candle	---
*fpm	feet per minute	---
*fps	feet per second	---
f_s	spatial frequency	---
*ft	feet	---

MASTER LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS
(Continued)

Abbreviation	Definition	Units
G	structural damping coefficient	---
GAAF	ground avoidance advisory function	---
GAC	general avionic computer	---
GBU	guided bomb unit	---
GC	gyro compass	---
*GCA	ground controlled approach	---
GCSE	great circle steering error	---
GCU	generator control unit	---
GE	General Electric	---
GEO	geosynchronous	---
GFAE	government-furnished aerospace equipment	---
GFE	government-furnished equipment	---
*GHz	gigahertz	---
GLCM	ground launched cruise missile	---
GM	ground map	---
*GMT	Greenwich Mean Time	hr:min:sec
GMTI	ground moving target indicator	---
GMTT	ground moving target track	---
GND	ground	---
*GPS	global positioning system	---
GRD	guard	---
GS	groundspeed	---
G/S	glideslope	---
GSU	ground support unit	---
GT	globe temperature	deg
GTC	gas turbine compressor	---
GUN	gun mode	---
GVT	ground vibration test	---
GW	gross weight	lb
*g	acceleration due to gravity	32.2 fps^2
*gal	gallon(s)	---
*gph	gallons per hour	---
*gpm	gallons per minute	---

MASTER LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

Abbreviation	Definition	Units
*gps	gallons per second	---
g/m^3	grams per cubic meter	---
g_x	acceleration in longitudinal axis of body	g
g_y	acceleration in lateral axis of body	g
g_z	acceleration in vertical axis of body	g
H	total enthalpy	Btu per lb
H	geopotential altitude	ft
HAMOTS	high accuracy multiple object tracking system	---
HARM	high-speed antiradiation missile	---
HAT	height above target	---
*HF	high frequency	---
HF	human factors	---
HFT&E	human factors test and evaluation	---
HITL	hardware in the loop	---
HMS	helmet-mounted sight	---
HOC	hot-on-cold	---
HOJ	home on jamming	---
HOME	cruise energy management mode	---
HQDT	handling qualities during tracking	---
HPRF	high pulse repetition frequency	---
HPT	high-pressure turbine	---
HQII	Have Quick II	---
HSD	Human Systems Division	---
HSI	horizontal situation indicator	---
HUD	head-up display	---
H_c	pressure altitude	ft
H_d	density altitude	ft
Hg	mercury	---
H_{ic}	indicated pressure altitude corrected for instrument error	ft
*Hz	hertz	---

MASTER LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

Abbreviation	Definition	Units
h	tapeline altitude	ft
h	specific enthalpy	Btu per lb
*hp	horsepower	550 ft-lb/sec
*hr	hour	---
ΔH_p	altimeter position error	ft
ΔH_{pc}	correction for altimeter position error	ft
*IAS	indicated airspeed	kt
IAW	in accordance with	---
IBIT	initiated built-in-test	---
*ICBM	intercontinental ballistic missile	---
ICD	interface control document	---
ICP	integrated control panel	---
ICS	interphone communications set; intercommunications system	---
*ID	identification	---
IDAL	Integrated Defense Avionic Lab	---
IDDP	improved diagnostic data pod	---
IDG	integrated drive generator	---
IDS	integrated display set; independent disconnect system; infrared detecting set	---
IF	intermediate frequency	---
IFA	in-flight alignment	---
IFAST	integration facility for avionic systems test	---
IFC	integrated functional capability	---
IFDAPS	integrated flight data processing system	---
*IFF	identification friend or foe	---
IFFC	integrated flight and fire control	---
IFOV	instantaneous field of view	---
IFR	instrument flight rules; initial flight release	---
IGC	integrated gear case	---
IGV	inlet guide vanes	---
IIR	imaging infrared	---

MASTER LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

Abbreviation	Definition	Units
*ILS	instrument landing system	---
*IMC	instrument meteorological conditions	---
I&M	improvement and modernization	---
IMN	indicated Mach number	---
IMU	inertial measuring unit	---
INATS	integrated avionic test station	---
INC	increment	---
*INS	inertial navigation system	---
INT	internal	---
INTL	interleave	---
INU	inertial navigation unit	---
INV	inventory	---
IOC	initial operational capability	---
*IOT&E	initial operational test and evaluation	---
*IP	initial point; instructor pilot	---
*IR	infrared	---
IRCM	infrared countermeasures	---
IRIG	Inter-Range Instrumentation Group	---
IRP	intermediate rated power	---
IRR	infrared radiation	---
IR/UV	infrared/ultraviolet	---
ISE	integrated systems evaluation	---
ISM	installation spectrum manager	---
ISTF	installed system test facilities	---
ITAR	International Traffic in Arms Regulation	---
ITP	integrated test plan	---
ITV	integrated test vehicle	---
i	angle of incidence	deg
*in	inch(es)	---
inbd	inboard	---
*JCS	Joint Chiefs of Staff	---
JETT	jettison	---
*JFS	jet fuel starter	---

MASTER LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

Abbreviation	Definition	Units
JON	job order number	---
*JOVIAL	Military Standard 1589B J73 programming language	--- ---
JRMET	joint reliability and maintainability evaluation team	---
JTF	joint test force	---
K	kelvin	deg
K	kilobytes	---
K	thermal conductivity	Btu/ft-sec-deg
*KCAS	knots calibrated airspeed	---
*KEAS	knots equivalent airspeed	---
KGS	knots groundspeed	---
*KIAS	knots indicated airspeed	---
KMR	Kwajalein Missile Range	---
KQ	torque constant	dimensionless
*KTAS	knots true airspeed	---
Kt	temperature probe recovery factor	dimensionless
kcal	kilocalories	---
kg	kilogram	---
*kHz	kilohertz	---
kip	units of 1,000 pounds	---
*km	kilometer	---
*kt	knot(s)	---
*kVA	kilovoltampere	---
*kW	kilowatts	---
L	aircraft lift	lb
L	rolling moment	in-lb
LADD	low altitude drogue delivery	---
LAN	launcher unit; local area network	---
LANTIRN	low-altitude navigational targeting infrared for night	---
LAPES	low altitude parachute extraction system	---
LAU	launcher unit	---
LCH	launcher	---

MASTER LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

Abbreviation	Definition	Units
LCOS	lead computing optical sight	---
LCD	liquid crystal display	---
L/D	ratio of lift to drag	dimensionless
LDR	laser designator ranger	---
LE	leading edge	---
LED	leading edge down; light emitting diode	---
LEF	leading edge flap	---
LEU	leading edge up	---
L/ESS	loads/environment spectra survey	---
*LF	low frequency	---
LG	landing gear	---
LGB	laser-guided bomb	---
LIRB	large infrared board	---
LIST	list page on DED	---
LIT	lead into turn	---
LLLTV	low light level television	---
LM	load management	---
LMFD	left multifunction display	---
LOC	localizer	---
*LORAN	long-range navigation	---
LOS	line of sight	---
LOSS	line of sight seeker slaving	---
*LOX	liquid oxygen	---
LPI	low probability of intercept	---
LPRF	low pulse repetition frequency	---
*LRU	line replaceable unit	---
LWC	liquid water content	g/m^3
LWD	left wing down	---
lat	lateral	---
*lat	latitude	deg
*lb	pound(s)	---
*lb/min	pounds per minute	---
*long.	longitude	deg

MASTER LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

Abbreviation	Definition	Units
*long.	longitudinal	---
M	flight or free stream Mach number	dimensionless
M	pitching moment	in-lb
MAC	mean aerodynamic chord	---
*MAC	Military Airlift Command	---
MAGVAR	magnetic variation	---
*MAJCOM	major command	---
MAN	manual	---
MAP	Military Assistance Program	---
MARK	mark point	---
MARS	midair recovery system	---
MAU	munitions adapter unit	---
*MAX	maximum	---
MBAL	manual ballistics	---
MBC	missile boresight correlator	---
MBL	manual boom latching	---
*Mc	megacycle	---
MCP	maximum continuous power	---
MCT	maximum continuous thrust	---
MDR	material deficiency report	---
MEA	minimum en route altitude	---
MED	medium	---
MER	multiple ejector rack	---
MFD	multifunction display	---
MFL	maintenance fault list	---
MGC	mean geometric chord	ft
MGM	materiel group manager	---
*MHz	megahertz	---
MICAP	mission incapable part	---
MIL	military	---
*MIL SPEC	military specification	---
*MIL-STD	military standard	---

MASTER LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS
(Continued)

Abbreviation	Definition	Units
MIP	mean impact point; materiel improvement project	---
MIPRB	materiel improvement project review board	---
MIRV	multiple independently targetable reentry vehicle	---
MK	mark	---
MKPT	mark point	---
MLE	missile launch envelope	---
MLG	main landing gear	---
MLPRF	modular low-power radio frequency	---
MLS	microwave landing system	---
MMAC	materiel management aggregation code	---
MMH	maintenance man-hours	hr
MMHE	munitions materiel handling equipment	---
MMH/FH	maintenance man-hours per flying hours	hr
MMW	millimeter wave	---
MNS	mission need statement	---
MOA	memorandum of agreement; military operating area	---
MOB	main operating base	---
MOE	measure of effectiveness	---
MOM	measures of merit	---
MON	monitor	---
MOP	measure of performance	---
MORTE	Multispectral Open-Air Test Environment	---
MOU	memorandum of understanding	---
MP	manifold pressure; mission planning	in Hg
MPD	multipurpose display	---
MPRF	medium pulse repetition frequency	---
MRB	material review board	---
MRGS	multiple reference gunsight	---
MRP	military rated power	hp
MRT	military rated thrust	lb
MRTD	minimum resolvable temperature difference	deg
MTBM	mean time between maintenance	---

MASTER LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

Abbreviation	Definition	Units
MTTR	mean time to repair	---
MSA	minimum safe altitude	ft
M-SEL	mode select	---
MSIP	multinational staged improvement program	---
*MSL	mean sea level; missile	---
MSL OVRD	missile override	---
MSMD	master mode	---
MSS II	Mission Support System II	---
MSO	material safety officer	---
MTBM	mean time between maintenance	hr
MTT	multitarget track	---
MUX	multiplex	---
MVD	mean volumetric droplet dimension	micron
MWOD	multiple words of day	---
M_{cr}	critical Mach number	dimensionless
M_{dd}	drag divergence Mach number	dimensionless
m	mass	slug
*m	meter	---
mag	magnetic	---
mbar	millibar	---
*mil	milliradian	---
*min	minute; minimum	---
mips	million instructions per second	---
*mm	millimeter	---
*mph	miles per hour	---
mrad	milliradian	---
ms	millisecond	---
N	normal	---
N	yawing moment	in-lb
N	rotational speed	rpm
N/A	not applicable	---
NAM	nautical air miles	---

MASTER LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

Abbreviation	Definition	Units
NAMPP	nautical air miles per pound of fuel	---
NAMT	nautical air miles traveled	nm
NAF	naval air facility	---
NARF	navigation alignment refining feature	---
NAS	naval air station	---
*NASA	National Aeronautics and Space Administration	---
NATC	Naval Air Test Center	---
*NATO	North Atlantic Treaty Organization	---
NAV	navigation	---
NAVAID	navigation aid	---
NAWCWPNS	Naval Air Warfare Center, Weapons Division	---
NBDU	nuclear bomb dummy unit	---
NDI	nondestructive inspection; nondevelopment items	---
NFOV	narrow field of view	---
NHA	next higher assembly	---
NLG	nose landing gear	---
NMK	nuclear mark	---
NOCM	nuclear ordnance commodity management	---
NOF	north of	---
*NORAD	North American Aerospace Defense	---
NORM	normal	---
NRC	Nellis Range Complex	---
NRIU	nuclear remote interface unit	---
NRP	navigation reference point; normal rated power	lb
NRT	normal rated thrust	---
NSA	National Security Agency	---
NSN	national stock number	---
NSTL	nose-tail	---
NT	neutral track	---
NTIS	National Technical Information System	---
NVG	night vision goggles	---
NVP	navigation pod	---
NWS	nosewheel steering	---

MASTER LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

Abbreviation	Definition	Units
N_1	fan speed	---
N_2	core speed	---
*No.	number	---
n	load factor; g	dimensionless
nav	navigation	---
*nm	nautical miles	---
n_x	longitudinal load factor (along x-body axis)	g
n_y	lateral load factor (along y-body axis)	g
n_z	normal load factor (along z-body axis)	g
O&M	operations and maintenance	---
OA	operations analysis	---
OAP	offset aimpoint	---
OAR	open-air range	---
OAT	outside air temperature	deg
OFLY	over fly	---
*OFP	operational flight program	---
OHA	operational hazard analysis	---
OI	operating instruction	---
OPCOM	operating command	---
OPR	Office of Primary Responsibility	---
*OPSEC	operational security	---
ORD	operational requirements document	---
OSB	option select button	---
*OSD	Office of Secretary of Defense	---
OSI	Office of Special Investigations	---
OSO	offensive systems operator	---
OT	operational transition	---
OTF	operating time at failure	---
*OT&E	operational test and evaluation	---
OVRD	override	---
OW	obstacle warning	---
OWL	obstacle warning line	---

MASTER LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

Abbreviation	Definition	Units
*O_2	oxygen	---
P	pressure	lb per ft^2
PA	pressure altitude; power approach	---
*PACAF	Pacific Air Forces	---
PAL	permissive action link	---
PB	precision bombing	---
*PC	personal computer	---
PCM	pulse code modulation	---
PCO	Procurement Contracting Office	---
PCR	publication change request	---
PCU	power control unit	---
PD	project directive	---
PDG	programmable display generator	---
PDM	pulse duration modulation; programmed depot maintenance	---
PDR	preliminary design review	---
PDU	power drive unit	---
PEC	program element code	---
PFL	pilot fault list	---
PFLD	pilot fault list display	---
P&FQ	performance and flying qualities	---
PGM	product group manager	---
PID	program introduction document	---
PIDS	Prime Item Development Specification	---
PIO	pilot-induced oscillation; pilot-in-the-loop	---
PIRA	precision impact range area	---
PIWG	product improvement working group	---
PLA	power lever angle	---
PLF	power for level flight	---
PLSS	precision location strike system	---
PM	preventive maintenance; program manager	---
PMD	program management directive	---
PME	precision measurement equipment	---

MASTER LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

Abbreviation	Definition	Units
PMEL	precision measurement equipment laboratory	---
PMO	program management office	---
PMRT	program management responsibility transfer	---
PMTC	Pacific Missile Test Center	---
*PN	part number	---
PNVP	production navigation pod	---
POC	point of contact	---
*POL	petroleum oil and lubricants	---
POM	program objective memorandum	---
POS	position	---
PPB	positive pressure breathing	---
PPI	plan position indicator	---
PR	progress report	---
PRE	preplanned	---
PRF	pulse repetition frequency	---
PRI	pulse repetition interval	---
PRIMES	Preflight Integration of Munitions and Electronic Systems	---
PRO	proverse	---
PROF	profile	---
PROG	programmable	---
PROLOG	PROgramming in LOGic	---
PROM	programmable read only memory	---
PRR	preliminary report of results	---
PSP	programmable signal processor; primary support point	---
P/T	position and time	---
PTO	participating test organization; power takeoff preliminary technical order	---
PVA	position, velocity, and acceleration	---
PVI	pilot-vehicle interface	---
PV-WAV	precession visuals workstation analysis and visualization environment	---
PW	Pratt & Whitney	---

MASTER LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

Abbreviation	Definition	Units
PWM	pulse width modulation	---
PWR	power	---
P_a	atmospheric or ambient pressure	lb per ft^2
P_k	probability of kill	---
P_s	specific excess power	ft/sec
P_s	static pressure	lb per ft^2
P_t	total pressure	lb per ft^2
P_{t2}	compressor inlet total pressure	in Hg
P_{t7}	turbine exit total pressure	in Hg
p	roll rate	deg per sec
p_{avg}	average roll rate	deg per sec
p_b	body axis roll rate	deg per sec
*pct	percent	---
*pph	pounds per hour	---
*ppm	pounds per minute	---
*psf	pounds per square foot	---
*psi	pounds per square inch	---
psia	pounds per square inch absolute	---
psid	pounds per square inch differential	---
psig	pounds per square inch gauge	---
QA	quality assurance	---
QAS	quality assurance specialist	---
QC	quality control	---
QEC	quick engine change	---
QRA	quick reaction alert	---
QRC	quick reaction capability	---
QRIP	quick response instrumentation package	---
QT&E	qualification test and evaluation	---
q	dynamic pressure	lb per ft^2

MASTER LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

Abbreviation	Definition	Units
q	pitch acceleration	deg per sec^2
q	pitch rate	deg per sec
q_b	body axis pitch rate	deg per sec
R	Rankine; recommendation	---
RALT	radar altimeter	---
*R&D	research and development	---
*R&M	reliability and maintainability	---
*R&R	remove and replace	---
RADFAG	radar fidelity and geometric range	---
RAM	random access memory; radar absorbing material	---
RAPCON	radar approach control	---
RAT	ram air turbine	---
RATSCAT	radar target scatter facility	---
RBS	radar bomb scoring	---
RC	radar computer	---
R/C	rate of climb	ft per sec
RCN	report control number	---
RCR	runway condition reading; raid cluster resolution	---
RCS	radar cross section; reaction control system	---
R/D	rate of descent	ft per sec
RDD	required delivery date	---
RDIP	radar diagnostic instrumentation pod	---
RDT&E	research, development, test and evaluation	---
RDY	ready	---
REMIS	reliability and maintainability information system	---
RER	radial error rate	---
RF	radio frequency	---
RFA	radio frequency authorization	---
RHAW	radar homing and warning	---
RIU	radar interface unit	---
RIW	reliability improvement warranty	---
RL	Rome Laboratory	---

MASTER LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

Abbreviation	Definition	Units
RLG	ring laser gyro	---
RMCC	Ridley Mission Control Center	---
RNI	Reynolds number index	---
RNG	range	ft
ROC	required operational capability	---
ROD	report of discrepancy	---
ROE	rules of engagement	---
*ROM	read only memory	---
RP	reference point; release pulse; reserve personnel	---
RPIE	real property installed equipment	---
RPV	remotely piloted vehicle	---
R/S	rate of sink	ft per min
R/T	receiver/transmitter	---
RSC	runway surface condition	---
RST	reset	---
RSU	rate sensor unit	---
RTB	return to base	---
RTO	refused takeoff; responsible test organization	---
RTS	return to search	---
RWD	right wind down	---
RWR	radar warning receiver	---
RWS	range while search	---
RWU	right wing up	---
Re	Reynolds number	dimensionless
r	yaw rate	deg per sec
rad	radian	---
r_b	body axis yaw rate	deg per sec
rec	recovery	---
rms	root mean square	---
*rpm	revolutions per minute	---
S	wing area	ft^2
SA	security assistance	---
*SAC	Strategic Air Command	---

MASTER LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

Abbreviation	Definition	Units
SACCS	strategic automated command and control system	---
SAD	search altitude display	---
SAFPAR	Secretary of the Air Force Program Assessment Review	---
SAM	surface-to-air missile; situation awareness mode; special air mission	---
SANDS	standard analog to digital system	---
SAS	stability augmentation system	---
SBC	symbology, brightness, and contrast	---
SBSS	standard base supply system	---
SCAS	stability and control augmentation system	---
SCM	signal conditioner multiplex	---
SCP	set clearance plane	---
SCU	signal control unit	---
SD	standard deviation	ft
SDC	situation display console; signal data converter	---
SDP	software development plan	---
SE	support equipment	---
SEDS	system effectiveness data system	---
SEE	special electronic equipment	---
SEG	systems engineering group	---
SEP	spherical error probable	---
SEQ	sequence	---
SFC	specific fuel consumption	lb per hr
SFO	simulated flameout	---
SFTC	single face to customer	---
SFW	sensor fused weapon	---
SI	special instrumentation	---
SIF	selective identification feature	---
SIGINT	signal intelligence	---
SIL	system integration laboratories	---
SIOP	single integrated operations plan	---
SIM	simulate	---

MASTER LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

Abbreviation	Definition	Units
SJ	selective jettison	---
SL	sea level	---
SLAR	side-looking airborne radar	---
SLAVE	slaved to the line of sight of the radar	---
SLCM	submarine launched cruise missile	---
SM	single manager	---
SMO	Spectrum Management Office	---
SMS	stores management set	---
SMTH	smooth	---
*S/N	serial number	---
SNAP	snapshoot	---
SNR	signal-to-noise ratio	---
SOAP	spectrometric oil analysis program	---
SOC	statement of capability	---
SOI	sensor of interest	---
*SOP	standard operating procedure	---
SOR	source of repair	---
SOS	source of supply	---
SOW	statement of work	---
SP	support point	---
SPD	system program manager	---
SPL	sound pressure level	dB
SPI	system point of interest	---
SPO	system program office	---
SPOCO	single point of contact office	---
SPORT	space positioning optical radar tracking	---
SPR	single-point refueling	---
SPS	secondary power system	---
SR	service report	---
SRAM	short-range attack missile	---
SRB	safety review board	---
SS	super search	---
SSB	single sideband	---

MASTER LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

Abbreviation	Definition	Units
SRU	shop replaceable unit	---
STBY	standby	---
STG	steering	---
STC	sensitivity time control	---
STILAS	Scientific Technical Information Library Automated System	---
STINFO	Scientific and Technical Information Office	---
STO	short takeoff	---
STOL	short takeoff and landing	---
STPT	steerpoint	---
STRG	steering	---
STS	space transportation system	---
STT	single-target track	---
SUU	suspension units underwing	---
S/V	survivability and vulnerability	---
S/W	software	---
SWAT	subjective workload assessment technique	---
SWIM	system-wide integrity management	---
SWIS	stores weight and inertia system	---
SYM	symbology	---
S_g	ground roll distance	ft
*sec	second(s)	---
seq	sequence	---
sta	station	---
sym	symbol	---
T	time constant	sec
TA	terrain avoidance; task analysis	---
T/A	throttle angle	deg
*TAC	Tactical Air Command; terminal access controller	---
*TACAN	tactical air navigation	---
TACS	Theater Air Control Systems	---
TAF	tactical air forces	---

MASTER LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

Abbreviation	Definition	Units
*TAS	true airspeed	kt
TAT	total air temperature	---
TAWC	Tactical Air Warfare Center	---
*TBD	to be determined	---
TBT	time of bar transition	---
TCG	time code generator; technical coordination group	---
TCN	transportation control number	---
TCP	technical coordination program	---
*TCTO	time compliance technical order	---
TCU	thrust control unit	---
TD	target designator, threshold detect	---
TDC	target designator control	---
TDM	time division multiples	---
TDR	teardown deficiency report	---
*TDY	temporary duty	---
TE	trailing edge	---
TED	trailing edge down	---
TEL	trailing edge left	---
TEMP	Test and Evaluation Master Plan	---
TER	triple ejector rack; test and evaluation report	---
TERS	test and evaluation results sheet	---
TERCOM	terrain correlation matching	---
TEU	trailing edge up	---
TEWS	tactical electronic warfare system	---
T&E	test and evaluation	---
TF	terrain following	---
TFCP	terrain following command program	---
TFOV	total field of view	---
TFR	terrain following radar	---
TFWC	tactical fighter weapons center	---
TGM	training guided missiles	---
TGP	targeting pod	---
TGT	target	---

MASTER LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

Abbreviation	Definition	Units
THP	thrust horsepower	550 ft-lb/sec
TIH	technical information handbook	---
TIM	technical information memorandum	---
TIS	test information sheet	---
TIT	turbine inlet total temperature	deg
TLF	thrust for level flight	lb
TLR	technical letter report	---
TM	technical manual; telemetry; trade mark; track mode	---
TMDE	test measurement and diagnostic equipment	---
TMO	tanker manual operation	---
TMS	target management switch	---
TO	takeoff	---
T.O.	technical order	---
TOA	time of arrival	---
TOD	time of day	---
TOF	time of flight; time of fail	---
TOS	time over steerpoint	---
TOV&V	technical order validation and verification	---
TPCC	targeting pod control computer	---
TPPS	targeting pod power supply	---
TPS	Test Pilot School	---
TPWG	test planning working group	---
TR	technical report	---
T/R	transformer/rectifier	---
TRB	technical review board	---
TRC	technological repair center	---
TRT	takeoff rated thrust	---
TRTN	track through the notch	---
TSFC	thrust specific fuel consumption	lb per hr/lb
TSI	time since installed	---
TSN	time since new	---
TSO	time since overhauled	---

MASTER LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

Abbreviation	Definition	Units
TSPI	time space position information	---
TTL	transistor-transistor logic	---
TTR	Tonopah Test Range	---
TTY	teletypewriter	---
TUA	time until active	---
TUA/I	time until active/impact	---
TUI	time until impact	---
TV	television	---
T/W	thrust to weight ratio	dimensionless
TWF	tail warning function	---
TWS	track while scan	---
TWT	traveling wave tube	---
T_t	total temperature	deg
t	temperature	deg
t	torsion	in-lb
t_a	ambient or atmospheric temperature	deg
*temp	temperature	deg
t_f	fuel temperature	deg
UARRSI	universal aerial refueling receptacle slipway installation	---
UDS	universal documentation system	---
UFC	up-front control	---
UFTAS	uniform flight test analysis system	---
*UHF	ultrahigh frequency	---
ULS	up-look search	---
UMMIPS	uniform material movement and issue priority system	---
UNLK	unlock	---
*USA	United States Army	---
*USAF	United States Air Force	---
*USAFE	United States Air Forces Europe	---
USAFSAM	USAF School of Aerospace Medicine	---

MASTER LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

Abbreviation	Definition	Units
USG	unique signal generator	---
*USMC	United States Marine Corp	---
*USN	United States Navy	---
UTM	universal transverse Mercator	---
UTTR	Utah Test and Training Range	---
UV	ultraviolet	---
V	velocity	ft per sec
V	volts	---
VASI	visual approach slope indicator	---
VBS	video bomb scoring	---
VCO	voltage controlled oscillator	---
VCR	video cassette recorder	---
VCW	vertical clearance warning	---
VDT	visual display terminal	---
VERT	vertical	---
*VFR	visual flight rules	---
*VHF	very high frequency	---
VHS	video home system	---
VIP	visual impact point	---
VIS	visual; video impact scoring	---
VIWG	vehicle improvement working group	---
VLC	very low clearance	---
VMC	visual meteorological conditions	---
VMU	voice message unit	---
*VOR	VHF Omnidirectional Range	---
VRP	visual reference point	---
VS	velocity search	---
VSD	vertical situation display	---
VSTOL	vertical and short takeoff and landing	---
VTOL	vertical takeoff and landing	---
V&V	verification and validation	---
VI	inertial velocity	kt
V_c	calibrated airspeed	kt

MASTER LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

Abbreviation	Definition	Units
V_e	equivalent airspeed	kt
V_g	groundspeed	kt
V_i	indicated airspeed	kt
V_{max}	maximum speed at MAX thrust	kt
V_{mc}	minimum directional control speed	kt
V_{mca}	air minimum directional control speed	kt
V_{mcg}	ground minimum directional control speed	kt
V_{mil}	maximum speed at MIL thrust	kt
V_s	stall speed	kt
V_t	true airspeed	kt
V_w	wind velocity	ft per sec
V_z	vertical velocity	---
ΔVp	airspeed position error	kt
ΔVpc	airspeed position error correction	kt
v	shear	lb
W, WT	aircraft gross weight	lb
W	aircraft water line	---
W	Watts	watts
WAC	wide-angle conventional	---
WAR	wide-angle raster	---
WBS	work breakdown structure	---
WCS	weapon control system	---
WDR	warranty deficiency report	---
WEC	Westinghouse Electric Corp.	---
WFOV	wide field of view	---
WHOT	white hot	---
WIT	watch item	---
WITS	watch item tracking subsystem	---

MASTER LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

Abbreviation	Definition	Units
WMUX	weapons multiplex bus	---
WOW	weight-on-wheels	---
WP	warranty plan	---
WPN	weapon	---
WSMC	Western Space and Missile Center	---
WSMR	White Sands Missile Range	---
WSO	weapons systems officer	---
WSPAN	wing span	ft
WSR	weather surveillance radar	---
WUC	work unit code	---
WUT	windup turn	---
WX	weather	---
W_f	fuel flow	lb per hr
X	delta bomb range along track position	ft
XMTR	transmitter	---
Y	delta bomb range crosstrack position	ft
ZCL	zero clearance line; zero command line	---
*ZULU	Greenwich Mean Time	---
ZVEL	zero velocity	---
x, y, z	axes	---
Δ	increment of change	---
Λ	wing sweep angle	deg
α	angle of attack	deg
β	sideslip angle	deg
γ	climb angle	deg
γ	flightpath angle	deg
δ	pressure ratio	dimensionless
d_a	aileron deflection	deg
d_e	elevator deflection	deg
d_r	rudder deflection	deg
e	downwash angle	deg

MASTER LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Concluded)

Abbreviation	Definition	Units
e	radiation emissivity of any surface	dimensionless
z	damping ratio	dimensionless
η	efficiency	dimensionless
θ	pitch angle	deg
θ	temperature ratio	dimensionless
λ	pressure lag constant	sec
μ	absolute viscosity	lb-sec per ft^3
μ	friction coefficient	---
ν	kinematic viscosity	ft^2 per sec
ρ	atmospheric or air density	slug per ft^3
σ	Stefan-Boltzmann radiation constant	---
σ	density ratio	dimensionless
ϕ	bank angle, roll angle	deg
ψ	yaw angle	deg
ω	frequency	Hz
Subscripts		
a	ambient	---
avg	average	---
b	body axis	---
i	indicated	---
l	left	---
min	minimum	---
max	maximum	---
o	free stream condition	---
r	right	---
s	standard day conditions	---
sl	sea level	---
t	test day conditions	---
w	wind axis	---

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SAMPLE TEST PLAN

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PROJECT HAVE EXAMPLE

JOHN WAYNE
Avionics Engineer

MARCH 1992

TEST PLAN

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EDWARDS AIR FORCE BASE, CALIFORNIA
AIR FORCE MATERIEL COMMAND
UNITED STATES AIR FORCE

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Prepared by:

This test plan has been reviewed and is approved for publication: 17 March 1992

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JOHN WAYNE
Avionics Engineer

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JOAN OF ARC
Commander
412 Test Wing

____

CURT RUSSELL
Chief, Electronics Research Division

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13. ABSTRACT *(Maximum 200 words)*

This test plan presents the demonstration and validation procedures, concept, and rationale for the flight tests of the Project Have Example system. The objective of this effort is to gather data to validate the technical approach for satisfying the operational requirements for an improved radar warning receiver system for the Air Combat Command. The overall test objective will demonstrate the ability of the Have Example system to receive and identify pulsed radar threat signals in the 500 MHz to 20 GHz frequency range.

Tests will be conducted by the Air Force Flight Test Center (AFFTC), 412 Test Wing/DOC, Edwards AFB, California, from 13 to 17 April 1992 at the Lake Muroc AFB test range. Two tests requiring 6 hours of flight test and support will be performed. Testing was requested by the Air Combat Command and will be conducted under the authority of the System Program Office, as directed by the Program Management Directive 1234, Annex J. Testing will be conducted under AFFTC Job Order Number 123ABC.

14. SUBJECT TERMS
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PREFACE

This test plan presents the demonstration and validation procedures, concept, and rationale for the flight tests of the Project Have Example system. The objective of this effort is to gather data to validate the technical approach for satisfying the operational requirements for an improved radar warning receiver system for the Air Combat Command. The Have Example system consolidates previous technologies into a single system. The previous technologies were evaluated during ground and flight tests from 1984 through 1990.

Descriptions of the Have Example system, test support equipment, instrumentation, test methods, and test procedures are provided within this document. Data analysis, data products, and the reporting documentation required to support the flight tests are also discussed. Testing will be conducted at Lake Muroc AFB test range by the Air Force Flight Test Center, 412 Test Wing/DOC, Edwards AFB, California, from 13 to 17 April 1992. Testing was requested by the Air Combat Command, and will be conducted under the authority of the System Program Office, as directed by the Program Management Directive 1234, Annex J (Reference 1).

EXECUTIVE SUMMARY

This test plan presents the demonstration and validation procedures, concept, and rationale for the flight tests of the Project Have Example system. The objective of this effort is to gather data to validate the technical approach for satisfying the operational requirements for an improved radar warning receiver system for the Air Combat Command. The overall test objective will demonstrate the ability of the Have Example system to receive and identify pulsed radar threat signals in the 500 MHz to 20 GHz frequency range.

Tests will be conducted by the Air Force Flight Test Center (AFFTC), 412 Test Wing/DOC, Edwards AFB, California, from 13 to 17 April 1992 at the Lake Muroc AFB test range. Two tests requiring 6 hours of flight test and support will be performed. Testing was requested by the Air Combat Command and will be conducted under the authority of the System Program Office, as directed by the Program Management Directive 1234, Annex J (Reference 1). Testing will be conducted under AFFTC Job Order Number 123ABC.

Based on the attached Environmental Checklist, significant impacts on the human environment are not likely and no further environmental documentation is needed.

The Have Example system consolidates previous technologies into a single system. These technologies include signal identification, tracking, and direction finding. These technologies were evaluated separately during ground and flight tests from 1984 through 1990. This test will assess the signal identification process of Have Example since the system was fully integrated. Future phases will test the threat direction finding and tracking capabilities.

Have Example consists of an antenna, a receiver, a signal processor, and a human-machine interface. The detected radio frequency (RF) energy will be controlled and routed through an RF distribution unit to the receiver. Signals from the receiver are fed to a signal processor, which will identify the threat signal. Finally, all processed information will be routed to the human-machine interface which displays information to the operator.

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1.0 INTRODUCTION

1.1 General

This test plan presents the demonstration and validation procedures, concept, and rationale for the flight tests of the Project Have Example system. The objective of this effort is to gather data to evaluate the technical approach to satisfy the operational requirements for an improved radar warning receiver (RWR) system for the Air Combat Command. Testing will be conducted at Lake Muroc AFB, California, from 13 to 17 April 1992. Two tests requiring 6 hours of flight test and support will be performed.

Testing was requested by the Air Combat Command, and will be conducted under the authority of the System Program Office (SPO) as directed by the Program Management Directive 1234, Annex J (Reference 1). The responsible test organization is the Air Force Flight Test Center (AFFTC), Electronics Research Division, 412 Test Wing/DOC, Edwards AFB, California. The participating test organization is Lake Muroc AFB. Testing will be conducted under AFFTC Job Order Number 123ABC.

1.2 Background

The Have Example effort entails the development of a system which will be used for identification of pulsed threat radar signals. The contractor responsible for development and building of the Have Example system is Mary Smith, Inc., Milpitas, California.

Project Have Example consolidates previously developed technologies into an improved single system. These technologies include signal identification, tracking, and direction finding. These technologies were evaluated separately during ground and flight tests from 1984 through 1990. These tests are documented in the Seek Example I and II Test Reports (References 2 and 3). This test will assess the signal identification process of Have Example since the system was fully integrated. Future phases will test direction finding and tracking capabilities of Have Example.

1.3 Test Item Description

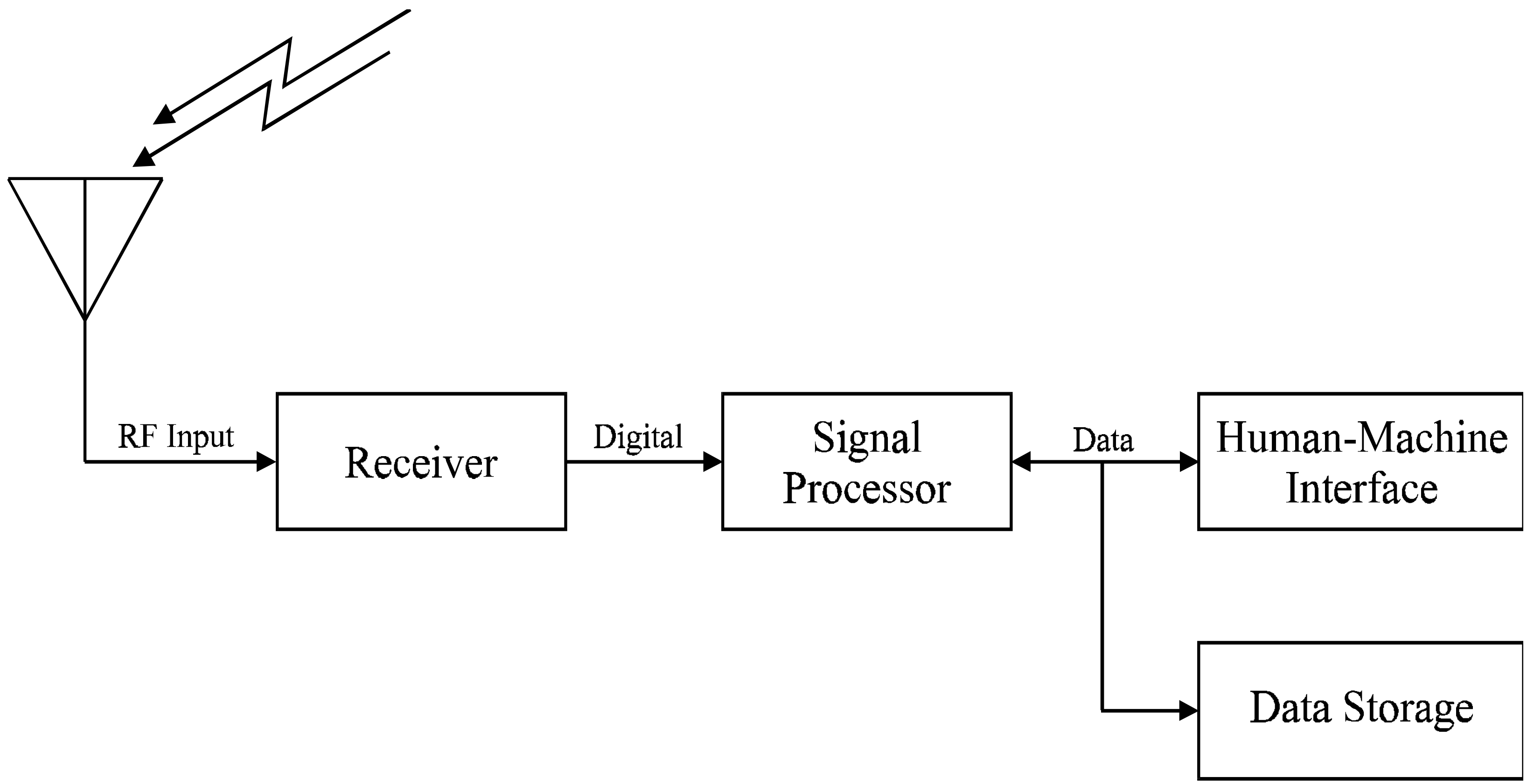
Have Example consists of an antenna, a receiver, a signal processor, and a human-machine interface (HMI) (Figures 1 and 2). The omni-directional antenna covers the frequency range of 500 MHz to 20 GHz. Energy received at the antenna is routed by a radio frequency (RF) distribution unit to the receiver. The receiver converts the RF signal into digital words which describe the signal characteristics. The digital words are routed to the signal processor which executes processing algorithms for signal identification. Resource management, control of system resources, and output to display devices are also performed by the signal processor. Processed information from the signal processor is routed to the HMI, which displays situational information to an operator, and to the storage device for data archiving.

1.4 Overall Test Objective

The overall test objective will be to demonstrate the ability of Have Example to process pulsed threat radar signals. This objective will be demonstrated by identifying the signals of interest (SOIs) of the threat system. Figure 3 reflects the Lake Muroc AFB emitter location and the flightpath of the test and support aircraft. The SOIs for this test are listed in Table 1.

1.5 Limitations

A high signal density is not possible due to the limited number of threat simulators at the Lake Muroc AFB test range. As a result, the Have Example system will not be tested at maximum capacity.



1 Have Example Block Diagram

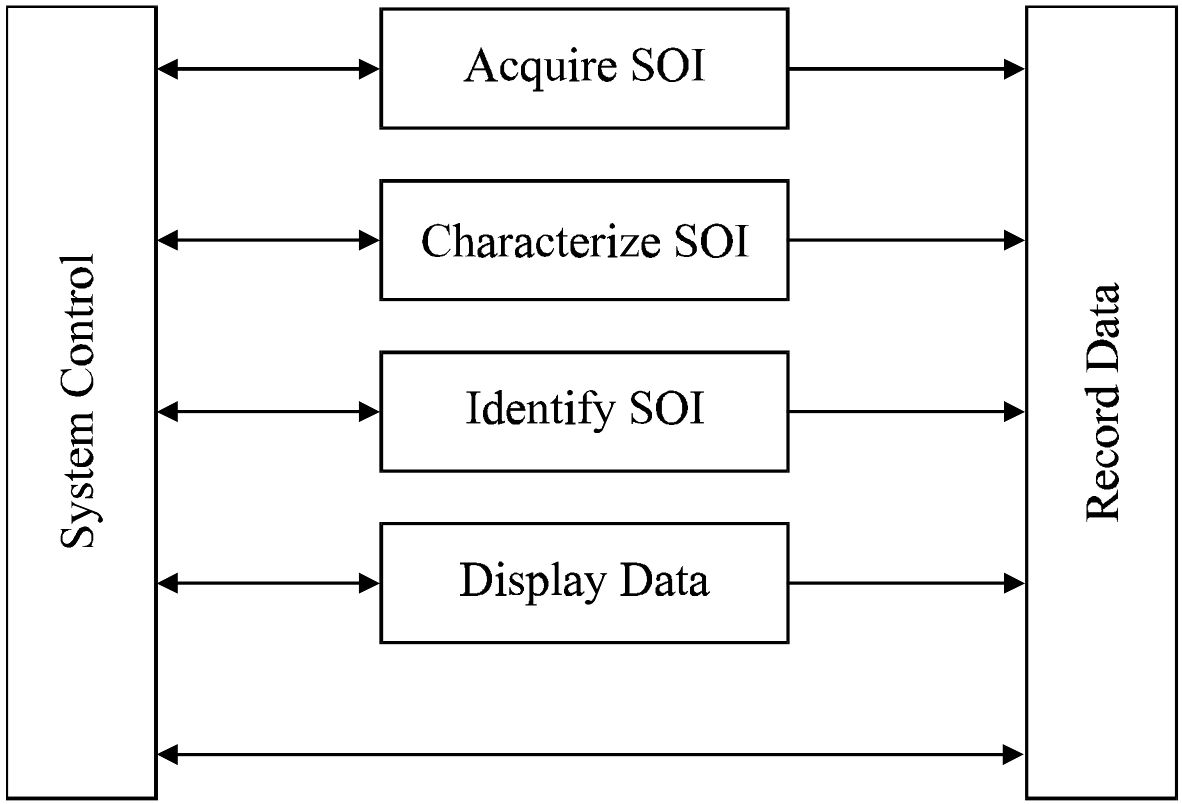


Figure 2 Functional Components of Have Example

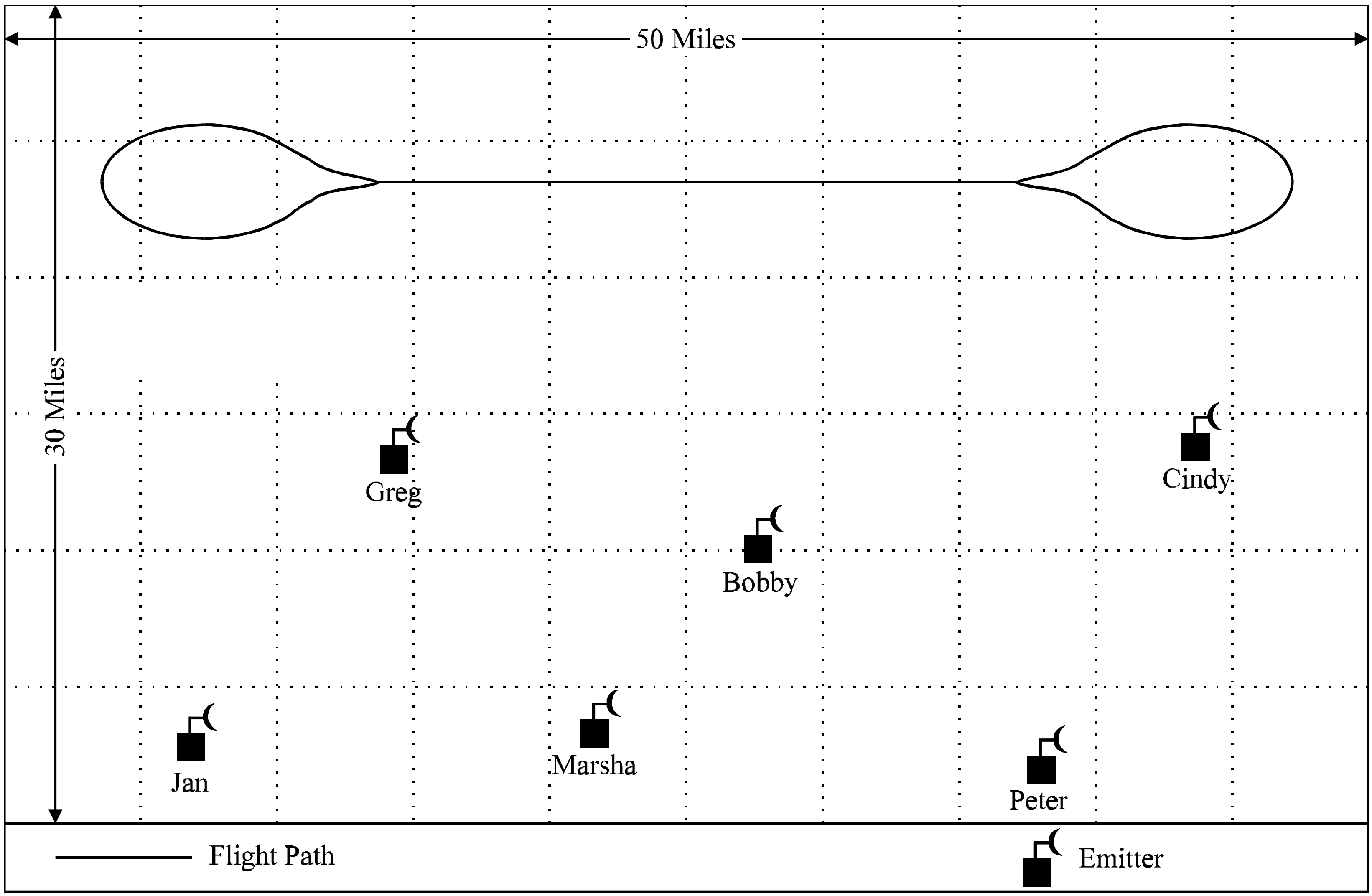


Figure 3 Emitter Location and Flightpath

Table 1
SIGNALS OF INTEREST TYPES

SOI Type	Signal Type
EW Radar	A & B
Height Finder Radar	A
Target Tracking Radar	A
Target Acquisition Radar	A & B

Notes: 1. SOI - signal of interest
2. EW - early warning

1.6 Test Resources

1.6.1 Test Aircraft

The test aircraft, the airborne avionics research testbed (AART), is provided, operated, and maintained by the 412 TW/DOC. The AART is a modified C-130A (Figures 4 and 5) configured to support avionics and electronic combat systems flight tests. The AART is equipped with a platform positioning system (PPS), communication station (CS), 60/400 Hz alternating current (ac) power, and has the mechanical and electrical connections for installation of the radio frequency signal environment monitor (RSEM) and Have Example. Platform position and attitude data are recorded with universal coordinated time (UCT) by the platform positioning system (PPS). The CS interfaces with the RSEM and the Have Example system and provides voice communication to ground systems. The CS also has the capability to record all communication, annotated with UCT. The Have Example antenna will be installed on the under side of the fuselage at fuselage station (FS) 650.

1.6.2 Test Range

The Lake Muroc AFB test range will be used for Have Example flight testing. The range will simulate six ground threat emitters and provide voice communication. The range will provide an FPS-16 tracker to track the AART. Figure 3 shows the location of the emitters. Data products required from the range include time space position information (TSPI) data from the range trackers and emitter on and off time. The range is also responsible for ensuring that all airspace requirements are met.

1.6.3 Instrumentation

The 412 TW/DOC will provide and operate the RSEM. The RSEM is test equipment and instrumentation used to acquire signal environment data to support post-test analysis. During testing, the RSEM will acquire and verify signals in the time and frequency domains and provide SOI location references to the Have Example operator for signal acquisition. For post-test analysis, the RSEM will provide reference data in the form of SOI event times, signal integrity, and plots in the time and frequency domains.

The threat system displays will be videotaped with super video home system (SVHS) recording. The threat system emitters are instrumented to record emitter on and off times.

1.7 Safety Requirements

There are no test-unique hazards envisioned during the conduction of these flight tests. This test plan will be submitted to the Lake Muroc AFB Safety Review Board for their review and approval no later than 30 days prior to testing.

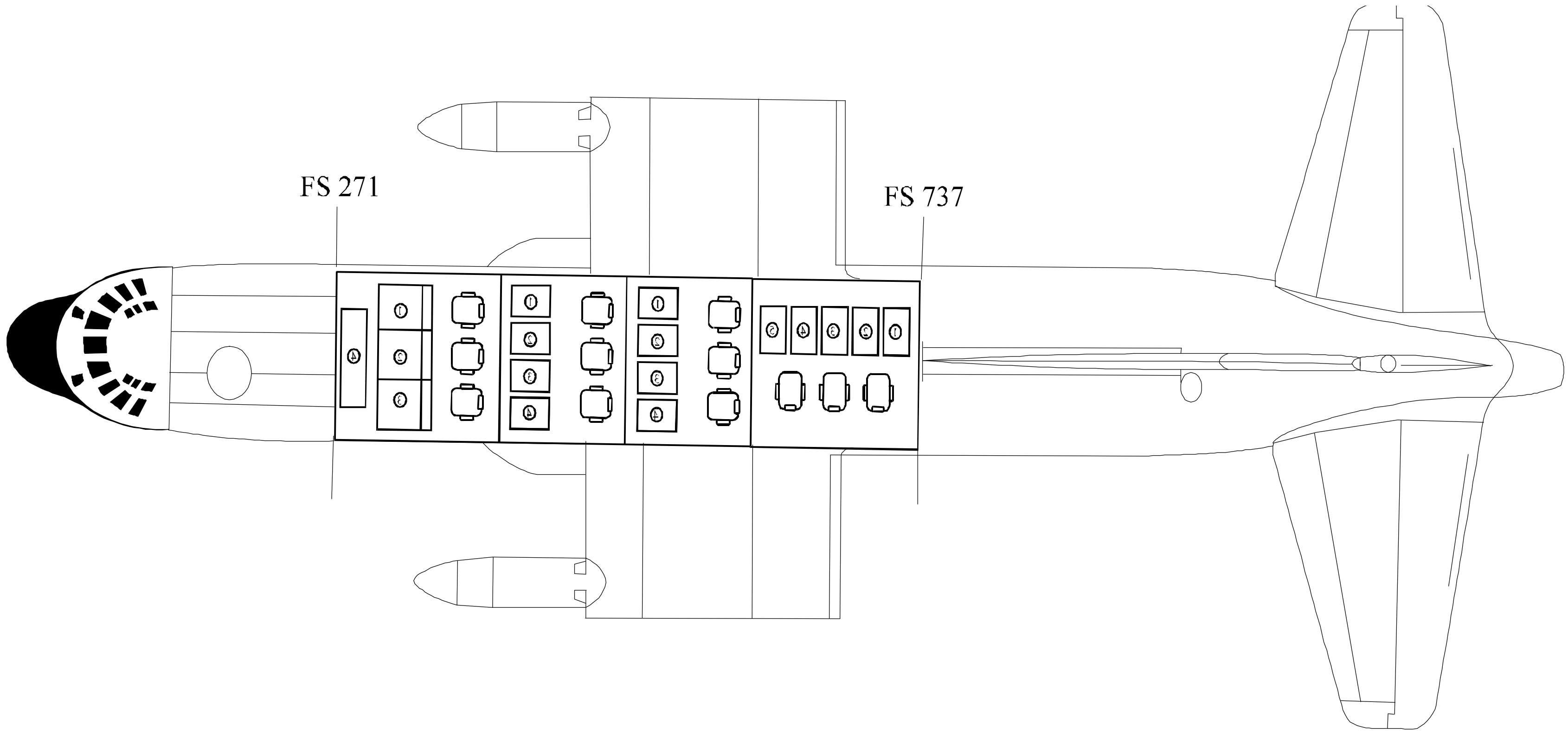


Figure 4 Airborne Avionics Research Testbed

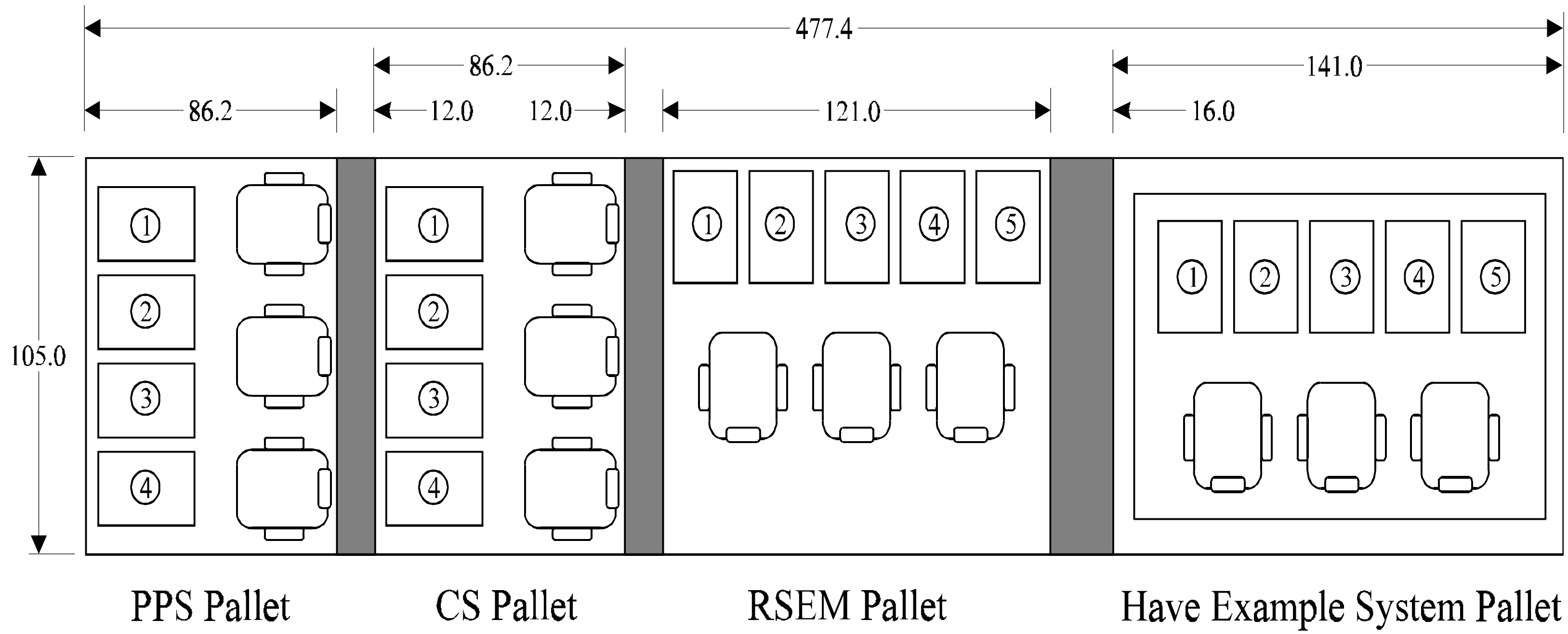


Figure 5 Airborne Avionics Research Testbed Pallet Configuration

1.8 Security Requirements

1.8.1 General Security

All test planning, procedures, data handling (duplication and delivery), and data analysis will be in accordance with (IAW) the *Have Example Security Classification Guide* (Reference 4). All classified data analysis will be accomplished in secure areas. Document handling has been considered IAW AFR 205-1, *Information Security Program Regulation* (Reference 5).

1.8.2 Operations Security

Operations security (OPSEC) has been considered IAW AFR 55-30, *Operations Security* (Reference 6). The following special procedures apply to this program:

a. The OPSEC measures applicable to this program will be briefed to Have Example personnel.

b. A Have Example controlled area with secure work space will be provided at Lake Muroc AFB. Only personnel with Project Have Example clearance will be granted access to the controlled area. Exceptions will be made by the Have Example test program manager.

c. Project Have Example classified material will be stored in a two drawer safe within the controlled area.

1.8.3 Communications Security

Communications security (COMSEC) has been considered IAW AFR 56-10, *COMSEC Users Guide* (Reference 7). Two special procedures are required:

a. Proper COMSEC procedures will be briefed to Have Example personnel.

b. STU III secure phones will be used for discussion of classified material.

1.9 Test Project Management

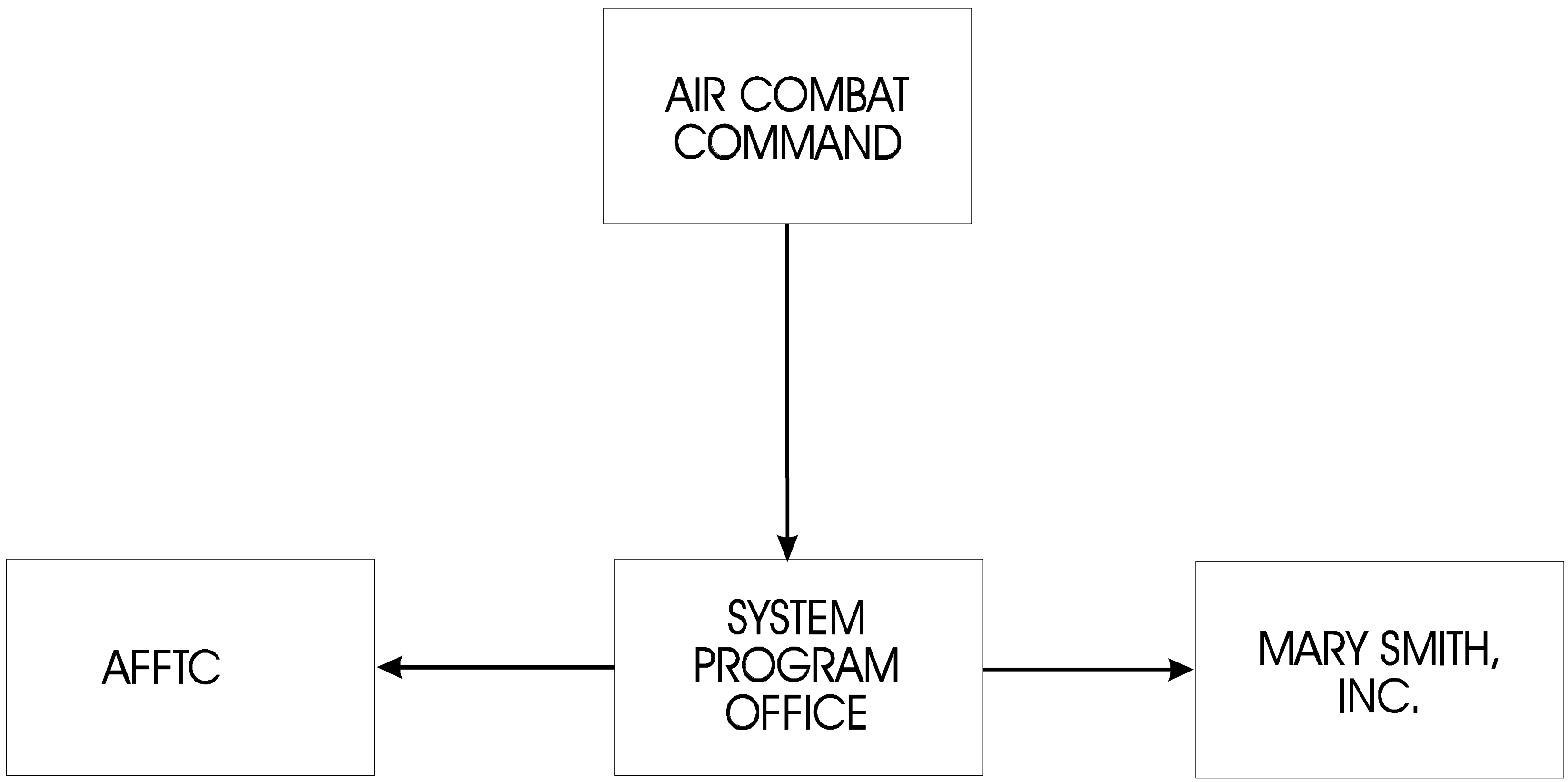
Figure 6 shows the overall project management and organization. The 412 TW/DOC is the responsible test organization for the Have Example demonstration and validation flight testing. Lake Muroc AFB is the participating test organization. Table 2 lists key Government and contractor personnel with responsibilities essential to the implementation of the flight tests. The test schedule for the Have Example system is shown in Figure 7.

1.10 Test Environment

Tests will be conducted in off-duty hours to minimize background radiation.

1.11 Environmental Impact Assessment

Based on the attached Environmental Checklist, significant impacts on the human environment are not likely and no further environmental documentation is needed.



6 Project Management and Organization

Figure 7 Have Example Master Test Schedule

Table 2
KEY GOVERNMENT AND CONTRACTOR PERSONNEL

Name	Organization	Title
Curt Russell	412 TW/DOC	Chief, Electronics Research Division
John Wayne	412 TW/DOC	Program Manager/Lead Engineer
Mary Sue Who	Mary Smith, Inc.	Program Manager/Contract Representative
Cindy Lou Who	Mary Smith, Inc.	Lead Engineer

2.0 TEST AND EVALUATION

2.1 General

The purpose of the Have Example flight test is to gather data to validate the technical approach for satisfying the operational requirements for an improved RWR system for the Air Combat Command. This effort will validate the integrated concept and lead to the development of the next generation RWRs.

The Have Example system will be used for identification of pulsed-threat radar signals. Testing will be conducted at Lake Muroc AFB, California, from 13 to 17 April 1992. Two tests requiring 6 hours of flight testing will be performed. The test condition matrix can be found in Appendix A. System and test deficiencies will be reported in deficiency reports.

2.2 Test Objectives

The specific Project Have Example objectives are listed in Table 3. Future development and testing phases will incorporate direction finding and tracking capabilities into the Have Example system.

2.2.1 Objective 1 - Signal Identification

Evaluate the Have Example signal ID process by measuring the percentage of correct signal ID compared to reference data, and the mean time required to identify a signal. Table 4 lists the SOIs to be acquired during flight testing. The measures of performance (MOPs) for this objective are:

a. Correct Signal ID Percentage

b. Mean time to ID

2.2.1.1 Measure of Performance 1 - Correct Signal Identification Percentage

Correct signal ID percentage will be determined by comparing the signals reported active from the Have Example to those reported active by RSEM and range instrumentation data. A ratio of these two quantities will be used to calculate correct signal ID percentage. Signals identified by Have Example which are not verified by the RSEM or range instrumentation data will be considered false alarms only if not reasonably expected to exist within the Have Example field of view (FOV).

2.2.1.1.1 Success Criteria

Acquire 20 samples, each approximately 30 seconds in duration, of recorded signal identification data for each signal.

2.2.1.1.2 Evaluation Criteria

Table 5 lists the evaluation criteria that will be used to evaluate the performance of the Have Example system. Each signal will be evaluated individually and then an overall evaluation will be made.

Table 3
SPECIFIC OBJECTIVES

Objective Number	Objective
1	Signal Identification
2	Direction Finding (Future)
3	Tracking (Future)

Table 4
SIGNALS OF INTEREST

Emitter ID	Signal/Function Type
Greg	EW Radar Type A
Peter	EW Radar Type B
Bobby	Height Finder Radar
Jan	Target Tracking Radar
Marsha	Target Acquisition Radar Type A
Cindy	Target Acquisition Radar Type B

Note: EW - early warning

Table 5
OBJECTIVE 1 MEASURE OF PERFORMANCE 1
EVALUATION CRITERIA

Correct Signal ID (pct)	Rating
80 to 100	Satisfactory
65 to 80	Marginal
Less than 65	Unsatisfactory

2.2.1.1.3 Final Data Products

Results will be presented as a plot of signal type versus percentage of correct signal IDs. If applicable, a plot of signal type versus percent false alarms will also be produced. A sample plot is shown in Figure 8.

2.2.1.1.4 Data Requirements

The following data types will be required for data reduction/analysis:

a. Have Example test data

b. Threat system instrumentation data

c. The RSEM data

2.2.1.1.5 Algorithms/Processes

The following algorithm will be used to calculate correct signal ID percentage:

$$\text{Correct Signal ID Percentage} = \frac{t_{CorrectHaveExample}}{t_{TotalHaveExample}} \; x \; 100$$

Where:

$t_{CorrectHaveExample}$ = the amount of time the Have Example system correctly identified a specific signal.

Note - Correct signal IDs are the Have Example IDs that match the reference sources IDs.

$t_{TotalHaveExample}$ = the total amount of time the Have Example system identified a specific signal. This time includes false signal IDs.

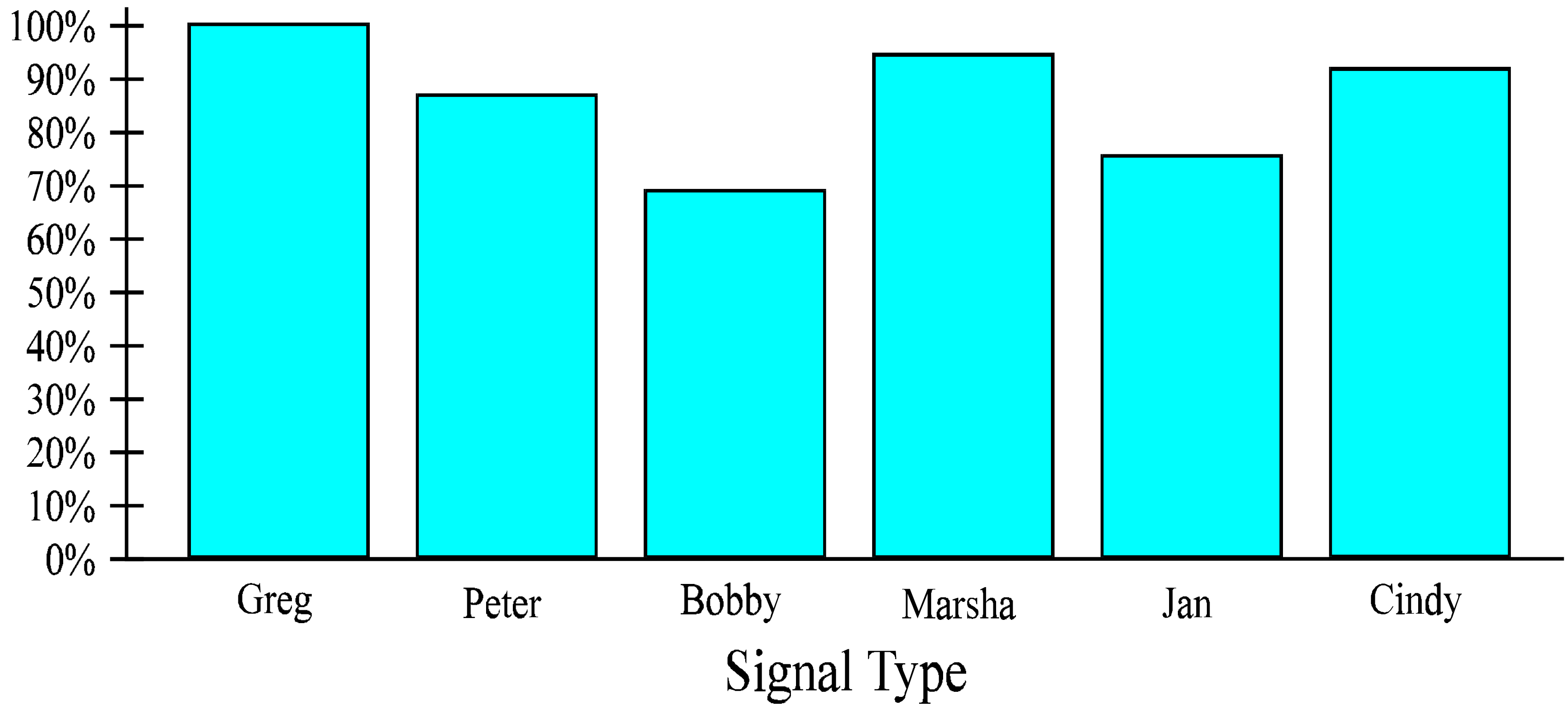
Note - False signal IDs are the Have Example IDs that do not match the reference sources IDs and are not possible in the Have Example FOV. False signal IDs do not include the Have Example signal IDs that do not match the reference sources IDs, but are possible in the Have Example FOV.

2.2.1.1.6 Test Methodology

The Have Example system and RSEM will be connected to the same antenna onboard the AART. The Have Example and RSEM will scan the environment to identify the SOIs. The signals identified by Have Example will be hand recorded on Form 1 of TIS F01. At the same time, the signals identified by the RSEM will be hand recorded on a separate form with the UCT time tag. The RF cable connecting Have Example to the antenna will be disconnected for 30 seconds to end the Have Example signal ID. The cable will be reconnected and the signals identified by Have Example will be recorded on a new form. At the same time, the signals identified by the RSEM will be hand recorded on a separate form with the UCT time tag. This will be repeated until enough data have been collected to satisfy the success criteria. These listings will be compared to determine correct signal ID percentage.

2.2.1.1.7 Expected Results

Sufficient data are expected to be acquired to meet all success criteria. Previous flight testing of the signal ID process yielded 90-percent correct signal ID. With the subsequent improvements to the process, a 93-percent correct signal ID evaluation is expected.



8 Signal Type Versus Correct Signal Identification Percent

2.2.1.2 Measure of Performance 2 - Mean Time to ID

Mean time to ID will be determined by measuring the difference in the time a correctly identified signal is displayed on the HMI and the time the Have Example system detected the signal.

2.2.1.2.1 Success Criteria

Obtain 10 identification-time samples for each SOI listed in Table 4.

2.2.1.2.2 Evaluation Criteria

Evaluation criteria for ID times are listed in Table 6. Each signal will be evaluated individually and then an overall evaluation will be made.

2.2.1.2.3 Final Data Products

Results will be presented as a plot of signal type versus mean signal ID time. A sample plot is shown in Figure 9.

2.2.1.2.4 Data Requirements

The following data will be required for data analysis:

a. Have Example test data

b. Threat system instrumentation data

c. The RSEM data

2.2.1.2.5 Algorithms/Processes

The following algorithm will be used to calculate the Have Example mean time to ID:

$$\text{Mean Time to ID} = \frac{\sum_{i=1}^{n} {}^{t}ID_i - {}^{t}D_i}{n}$$

Where:

t_{ID} = the time that ID of a specific signal occurred.

t_D = the time that the signal was first detected by the Have Example system. This will be verified by RSEM and range instrumentation data to ensure the signal was present.

n = the number of time-to-ID trials for a specific signal.

2.2.1.2.6 Test Methodology

The Have Example system and the RSEM will be connected to the same antenna onboard the AART. The RSEM will scan the environment to identify the SOIs. The RF cable connecting the Have Example to the antenna will be disconnected for 30 seconds to end the Have Example signal ID. The cable will be reconnected and this time will be noted on Form 1 of TIS F01. At the same time, a stopwatch will be started. When the signals have been identified, the stopwatch will be stopped and this time will be noted on the form. This will be repeated until enough data have been collected to satisfy the success criteria. The stopwatch data will be used for quick-look purposes. Data on the Have Example 520-MByte hard drive will be used for data analysis.

Table 6
OBJECTIVE 1 MEASURE OF PERFORMANCE 2
EVALUATION CRITERIA

Mean Time to ID (sec)	Rating
0 to 3	Satisfactory
3 to 6	Marginal
Greater than 6	Unsatisfactory

2.2.1.2.6 Expected Results

Sufficient data are expected to be acquired to meet all success criteria. Previous flight testing of the signal ID process yielded a 2.1-second mean time to ID. With the subsequent improvements to the process, a 2.0-second mean time to ID evaluation is expected.

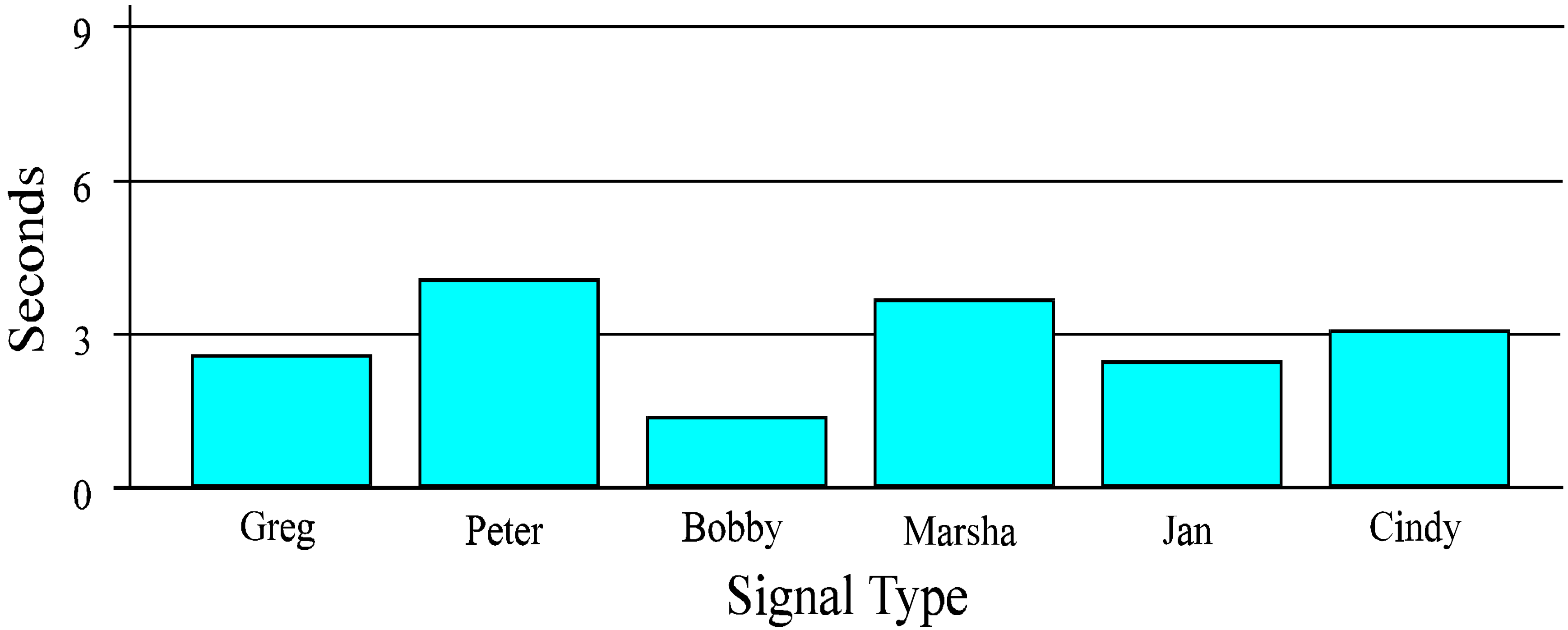


Figure 9 Signal Type Versus Mean Time to ID

3.0 TEST PROCEDURES

Flight testing will be conducted during a 1-week period. Each test will be 3 hours in duration. The test procedures will consist of:

a. Pretest briefing

b. Go/no-go decision

c. Equipment setup and initial checkouts

d. Conduct test

e. Post-test briefing

f. Test summary and quick-look analysis

g. Test objective status update

3.1 Pretest Briefing

A pretest briefing will be conducted by the AFFTC program manager prior to each test. This pretest briefing will include, but will not be limited to, the following:

a. Threat systems and Have Example system status

b. Test objectives

c. Instrumentation status

   (1) Test range and support equipment

   (2) Test aircraft and support equipment

   (3) The RSEM

   (4) Have Example

d. Test coordination

e. Security

f. Safety

3.2 Test Execution

The AFFTC 412 TW/DOC is the responsible test organization for the Have Example flight test. Table 7 lists key test team personnel with responsibilities essential to the implementation of the flight tests.

Table 7
KEY TEST TEAM PERSONNEL

Name	Organization	Function
Curt Russell	412 TW/DOC	Test Director
John Wayne	412 TW/DOC	RSEM Operator
Skippy Smith	412 TW/DOC	CS & PPS Operator
Rex "ACE" Reed	SPO	Test Monitor
Bart Simpson	SPO	Test Monitor
Jane Russell	Air Combat Command	Have Example Operator
Lisa Simpson	Air Combat Command	Have Example Operator
Homer Simpson	Air Combat Command	Have Example Operator
Mary Sue Who	Mary Smith Inc.	Contractor Support/Hardware
Cindy Lou Who	Mary Smith Inc.	Contractor Support/Hardware

Notes: 1. SPO - System Program Office
2. RSEM - radio frequency signal environment monitor
3. CS - communication station
4. PPS - platform positioning system

During testing, the test team personnel will not exceed the maximum number that can safely work in the AART. Support personnel will assist in conducting the tests as required. The test team will consist of the following:

a. The AFFTC - Three personnel will support the flight tests. This team will consist of a test director/test engineer, a CS and PPS operator/engineer, and a data analyst/RSEM operator. These personnel will record test activity in log books and operate the AFFTC data acquisition equipment and instrumentation.

b. Lake Muroc AFB - The test range personnel are responsible for operating all threat systems, threat system instrumentation, and TSPI equipment. They will also ensure no airspace violations occur. No Lake Muroc AFB personnel will be on board the AART.

c. Contractor - Two personnel will be deployed to support the flight tests. The team will consist of a hardware engineer and a software programmer. These personnel will setup and check out the Have Example system and equipment. Afterwards, they will provide support as required. At the conclusion of testing, the personnel will disassemble and pack the Have Example system and equipment for shipment.

d. System Program Office - Two personnel will be deployed to monitor the test activity.

e. Air Combat Command - Three personnel will be deployed to support the flight tests. These personnel will operate the Have Example system.

For each test, a test information sheet (TIS) will be followed and the test conducted and managed by the Have Example Test Director. The director will proceed through the TIS until all objectives have been satisfied and adequate test data have been acquired. The following illustrates a typical test scenario:

a. Signal acquisition will be conducted by the Have Example and RSEM searching the environment.

b. The RSEM will monitor and record the RF signal environment and SOIs. Recorded data will later serve as a comparison source for data analysis.

c. The Have Example display will be recorded on SVHS videotape.

d. The CS will record voice communication between the AART and Lake Muroc AFB.

e. The PPS will provide and record onboard platform time, position, and attitude data.

f. As the test progresses, the airborne test director will ensure that the Have Example operators complete the various combinations of test objectives. After the test has been completed, the Have Example operators will transfer the data on the 520-MByte hard drive to 44-MByte Bernoulli diskettes and complete a test summary form. At the same time, data from the threat systems and all test logbooks will be given to the test director. After the post-test briefing, AFFTC personnel will accomplish a quick-look analysis on the test data acquired.

g. The contractor will provide the Have Example recorded performance test data within 24 hours of test completion.

3.3 Post-Test Briefing

After each test, a post-test briefing will be held in a conference room at Lake Muroc AFB and will be conducted by the Have Example test program manager. This briefing will include, but not be limited to, the following:

a. Have Example performance/status

b. Instrumentation performance/status

(1) Test range and support equipment

(2) Test aircraft and support equipment

(3) The RSEM

(4) Have Example

c. Reference systems performance

d. Review and discussion of test

e. Action items

f. Collect mission summary reports

Each organization will submit a mission summary report following each test. The summaries will include an evaluation of the Have Example performance, comments on test conduct, and a list of problems encountered during the test.

3.4 Quick-Look Data Analysis

Quick-look data analysis will be accomplished after each test as follows:

a. Objective 1 MOP 1 - A comparison will be made of the Have Example forms with the reference system forms.

b. Objective 1 MOP 2 - The stopwatch times will be compared with the evaluation criteria.

4.0 TEST REPORTING

4.1 Deficiency Reports

Deficiency reports (DRs) will be written as problems are identified. The DRs will identify any system and test deficiencies noted during testing. These reports will be delivered to the Air Combat Command and the SPO within 2 workdays for Category 1 DRs and 13 days for Category 2 DRs after problems are identified. Any further release of the reports will be coordinated with the SPO.

4.2 Preliminary Report of Results

The AFFTC will write and present to both the Air Combat Command and SPO a preliminary report of results (PRR) 30 days after the test team and data have returned from deployment. The PRR will contain a qualitative assessment of the Have Example performance and a list of AFFTC technical recommendations for program continuation. This assessment will be based on the test engineers' observations, review of videotapes, quick-look data analysis, and limited analysis of selected portions of data. The PRR document will be IAW AFFTC-TIH-88-002 (Reference 8). Any further release of the report shall be coordinated with Air Combat Command.

4.3 Technical Report

A technical report will be written by the AFFTC after the completion of testing and the test team and data have returned from deployment. The report will be delivered to the Air Combat Command and the SPO within 120 days after data reduction is complete. Any further release of the report shall be coordinated with the SPO.

5.0 LOGISTICS

5.1 General

Each organization is responsible for providing transportation for their personnel to the test site. The contractor is responsible for transporting the Have Example system to the AFFTC 10 days prior to testing. The AFFTC will make billeting arrangements for Government and contractor personnel. Further details are contained in Appendix F.

REFERENCES

1. *Program Management Directive*, 1234 (8), Annex J, 19 March 1991

2. Frog, Jeremiah B., *Seek Example I Ground Subsystems Evaluation*, AFFTC-TR-26-01, Edwards AFB, California, January 1926.

3. Frog, Kermit T., *Seek Example II Flight Subsystems Evaluation,* AFFTC-TR-28-01, Edwards AFB, California, January 1928.

4. *Have Example Security Classification Guide*, 4 July 1776.

5. *Information Security Program Regulation*, AFR 205-1, 1987.

6. *Operations Security*, AFR 55-30, Volume 1, August 1988.

7. *COMSEC Users Guide*, AFR 56-10, July 1990.

8. *The Author's Guide to Writing AFFTC Technical Reports*, AFFTC-TIH-88-002, January 1993, Revision 3, 412 TW/STINFO, Edwards AFB, CA 93523-5000, January 1993.

APPENDIX A

TEST CONDITION MATRIX

Table A1
HAVE EXAMPLE TEST CONDITION MATRIX

Test Cond	Obj MOP	"T" Schedule	Threat Emitter XON/XOFF						Test Aircraft			Test Rsources					Comments
			Greg	Peter	Bobby	Marsha	Jan	Cindy	Flt Path	Alt	Spd	PPS	CS	RSEM	Rg Tkr	SUT	
N/A	1-1,1-2	T-30	XON	XON	XON	XON	XON	XON	A&B	10K	350	X	X	X	X	X	PRETEST
1	1-1	T+1	XON						A	10K	350		X	X			CAL RUN
2	1-1	T+15		XON					B	10K	350		X	X			CAL RUN
3	1-1	T+30			XON				A	10K	350		X	X			CAL RUN
4	1-2	T+45				XON	XON		B	10K	350		X	X			CAL RUN
5	1-2	T+60							A	10K	350		X	X			CAL RUN
6	1-2	T+76					XON	XON	B	10K	350		X	X			CAL RUN
7	1-1	T+90	XON		XON				A&B	10K	350	X	X	X	X	X	TEST RUN 1
8	1-2	T+120		XON		XON	XON	XON	A&B	10K	350	X	X	X	X	X	TEST RUN 2
9	1-1,1-2	T+150	XON	XON	XON	XON	XON	XON	A&B	10K	350	X	X	X	X	X	TEST RUN 3
N/A	1-1,1-2	T+180	XON	XON	XON	XON	XON	XON	A&B	10K	350	X	X	X	X	X	POSTTEST

A - Flight path A
A&B - Flight paths A and B
Alt - Altitude
B - Flifht path B
CAL RUN - California flight
CS - Communication System
Flt Path - Flight path
MOP - Measure of performance number
N/A - Not applicable

OBJ - Objective number
PPS - Platform positioning system
Rg Trk - Range tracker
RSEM - RF signal environment monitor
Spd - Speed
SUT - System under test
"T" Schedule - Time countdown schedule
Test Cond - Test condition number
XON - Transmitter on

APPENDIX B

REQUIREMENTS TRACEABILITY

Table B1
OBJECTIVES AND MOPs FOR THE HAVE EXAMPLE SYSTEM

Objective Number	Objective	MOP Number	MOP
1	Signal Identification	1	Correct Signal Identification Percentage
		2	Mean Time to Signal Identification
2	Tracking	TBD	TBD
3	Threat Direction Finding	TBD	TBD

Notes: 1. MOP - measure of performance
2. TBD - to be determined

Table B2
REQUIREMENTS TRACEABILITY

Objective	PID Paragraph No.	TEMP Paragraph No.	System Maturity Matrix	ORD Paragraph No.	MNS Paragraph No.	System Specification Paragraph No.
1 Signal Identification	3.2.1.1	4.1.4	3.2.2	4.3.2	5.2.3	3.2.9
2 Tracking	3.2.1.2	4.2.2	3.2.4	4.2.4	5.2.6	3.3.0
3 Threat Direction Finding	3.4.2.2	4.3.1	3.2.6	4.2.6	5.2.8	3.3.2

Notes: 1. MNS - mission need statement
2. ORD - operational requirements document
3. PID - program introduction document
4. TEMP - test and evaluation master plan

APPENDIX C

PARAMETERS LIST

PARAMETER LIST

Item	Parameter Name	Range	Resolution	Accuracy	Source	Sample Rate
1	Signal Detect/Identify Time (IRIG-B) and Message	500 - 20,000 MHz			SUT data bus with SUT set to range time	10 Hz
2	Signal Frequency		1kHz	±500 Hz	RSEM	10Hz
3	Threat System Emitter On/Off Time (IRIG-B) and Message				Greg Emitter, Peter Emitter, Bobby Emitter, Marsha Emitter, Jan Emitter, Cindy Emitter	10Hz
4	Range of the AART from Greg	0 - 300 nm	1 nm	±0.5 nm	PPS & FPS-16	12 samples per minute
5	Azimuth from Greg to the AART	0 - 360 deg	1 deg	±0.5 deg	PPS & FPS-16	12 samples per minute
6	MSL Altitude of the AART	0 - 11,000 ft	1 deg	±0.5 deg	PPS & FPS-16	12 samples per minute
7	Track Number		50 ft	±0.5 ft	PPS & FPS-16	12 samples per minute
8	Yaw of the AART	±45	0.1 deg	±0.5 deg	PPS & FPS-16	12 samples per minute
8	Pitch of the AART	±45	0.1 deg	±0.5 deg	PPS & FPS-16	12 samples per minute
10	Roll of the AART	±45	0.1 deg	±0.5 deg	PPS & FPS-16	12 samples per minute
11	Indicated Airspeed of the AART	0 - 400 kt	1 kt	±0.5 kt	PPS & FPS-16	12 samples per minute

APPENDIX D

DATA ANALYSIS PLAN

DATA ANALYSIS PLAN

1.0 OVERVIEW

This data analysis plan (DAP) appendix describes the source of each test data and the procedures by which the 412 TW/DOC will process the Have Example test data. These data include digital data from the Have Example and radio frequency signal environment monitor (RSEM), video, audio, and operator log sheets. The primary emphasis of this document will be processing the digital data. This plan also summarizes the range and reference system's data products used to evaluate the Have Example performance. Initial Have Example performance will be estimated from a limited quick-look analysis and will be summarized in the preliminary report of results. Assessment of overall Have Example performance will be based on indepth analysis and incorporated into the final test report. The measures of performance (MOPs) are cross-referenced to the DAP in Table D1.

Table D1
MEASURE OF PERFORMANCE (MOP) CROSS REFERENCE

Objective No.	MOP No.	DAP Paragraph	Quick-Look	In-Depth	Calculation
1	1	5.1.1	X	X	Correct Signal ID Percentage
	2	5.1.2	X	X	Mean Time to ID

Note: DAP **-** data analysis plan

2.0 REQUIRED DATA

The following data elements are required for data analysis:

a. Have Example signal detect/identify time and message

b. Signal frequency

c. Threat system emitter on/off time and message

d. Time space position information (TSPI) data

Detailed information on the source, engineering units, update rate, etc., is contained in Table D2.

Other data required include:

a. Have Example video display recordings

b. Test engineer notes

(1) Test logs

3.0 MEDIA AND DATA FORMAT

Table D3 identifies the test data source, the media on which the data will be provided, and the format the data are recorded in. Tables D4, D5, D6, and D7 contain the data formats.

Table D2
DATA SUMMARY TABLE

Data Elements	Objective - MOP No.	Units	Expected Range	Reference	Source	Media
Signal Detect/Signal Identify	1-1, 1-2	Text	SD - Signal Detect SI - Signal Identify: Greg Peter Bobby Marsha Jan Cindy		SSUTUT	44-MByte
Signal Frequency	1-1, 1-2	MHz	500 - 20,000		RSEM	Std. 3.5” floppy
Emitter Status	1-1, 1-2	Text	Emitter Name Emitter Status: 0 = Emitting 1 = Off		Emitter Instrument ation	Std. 3.5” floppy
Aircraft Range	N/A	nm	0 - 300	Greg	TSPI	Std. 3.5” floppy
Aircraft Azimuth	N/A	deg	0 - 360	Greg	TSPI	Std. 3.5” floppy
Aircraft Altitude	N/A	ft	0 - 11,000	MSL	TSPI	Std. 3.5” floppy
Track Number	N/A	None	000 - 999		TSPI	Std. 3.5” floppy
Aircraft Yaw	N/A	deg	± 45		TSPI	Std. 3.5” floppy
Aircraft Pitch	N/A	deg	± 45		TSPI	Std. 3.5” floppy
Aircraft Roll	N/A	deg	± 45		TSPI	Std. 3.5” floppy
Aircraft Indicated Airspeed	N/A	kt	0 - 400		TSPI	Std. 3.5” floppy

Notes: 1. MOP - measure of performance
2. RSEM - radio frequency signal environment monitor
3. nm - nautical mile
4. N/A - not applicable
5. TSPI - time space position information

Table D3
DATA FORMATTING

Source	Media	Format
Have Example System	44-MByte Bernoulli	ASCII II
Radio Frequency Signal Environment Monitor	Std 3.5-inch floppy	ASCII II
Threat Emitter Instrumentation	Std 3.5-inch floppy	ASCII II

Table D4
HAVE EXAMPLE DATA FORMAT

Columns	Format		Units	Content
001-003	I	3	Days	Elapsed days since Jan 1
004-004		1X	None	
005-006	I	2	Hours	Elapsed hours since current day
007-007		1X	None	
008-009	I	2	Min	Elapsed minutes since current hour
010-010		1X	None	
011-016	F	6.3	Sec	Elapsed seconds since current minute
017-020		4X	None	Blanks
021-022	C	2	None	SD - Signal Detected SI - Signal Identified
023-026		4X	None	Blanks
027-032	C	6	None	Signal identified: Greg Peter Bobby Marsha Jan Cindy

Table D5
RADIO FREQUENCY SIGNAL ENVIRONMENT MONITOR DATA FORMAT

Columns	Format		Units	Content
001-003	I	3	Days	Elapsed days since Jan 1
004-004		1X	None	;
005-006	I	2	Hours	Elapsed hours since current day
007-007		1X	None	;
008-009	I	2	Min	Elapsed minutes since current hour
010-010		1X	None	;
011-016	F	6.3	Sec	Elapsed seconds since current minute
017-020		4X	None	Blanks
021-026	F	6.3	MHz	Frequency of detected signal

Table D6
THREAT SYSTEM EMITTER INSTRUMENTATION DATA FORMAT

Columns	Format		Units	Content
001-003	I	3	Days	Elapsed days since Jan 1
004-004		1X	None	
005-006	I	2	Hours	Elapsed hours since current day
007-007		1X	None	
008-009	I	2	Min	Elapsed minutes since current hour
010-010		1X	None	
011-016	F	6.3	Sec	Elapsed seconds since current minute
017-020		4X	None	Blanks
021-029	C	6	None	Signal: Greg Peter Bobby Marsha Jan Cindy
023-026				Blanks
030-030	C			Signal Status: 0 - Signal Emitting 1 - Signal Off

Table D7
TIME SPACE POSITION INFORMATION DATA FORMAT

Columns	Format		Units	Content
001-003	I	3	Days	Elapsed days since Jan 1
004-004		1X	None	;
005-006	I	2	Hours	Elapsed hours since current day
007-007		1X	None	;
008-009	I	2	Min	Elapsed minutes since current hour
010-010		1X	None	;
011-016	F	6.3	Sec	Elapsed seconds since current minute
017-020		4X	None	Blanks
021-030	F	10.3	nautical mile (nm)	Range from Greg to aircraft in nautical miles
031-034		4X	None	Blanks
035-044	F	10.3	Deg	Azimuth from Greg to aircraft in degs
045-048		4X	None	Blanks
049-058	F	10.4	Feet	MSL altitude
059-062		4X	None	Blanks
063-067	I	5	None	Track Number
068-071		4X	None	Blanks
072-076	F	5.1	Deg	Yaw of aircraft
077-080		4X	None	Blanks
081-085	F	5.1	Deg	Pitch of aircraft
086-089		4X	None	Blanks
090-094	F	5.1	Deg	Roll of aircraft
095-098		4X	None	Blanks
099-101	I	4	Kt	Indicated airspeed of aircraft
081-085	F	10.3	nm	Range from Greg to aircraft in nm

4.0 DATA REDUCTION

All aircraft position and attitude data must be run through a ground processor to convert it from analog recordings to digital engineering units.

5.0 DATA ANALYSIS

5.1 Objective 1 - Signal Identification

Evaluate the Have Example signal ID process by measuring the percentage of correct signal ID compared to reference data, and the mean time required to identify a signal.

5.1.1 Measure of Performance 1 - Correct Signal ID Percentage

Correct signal ID percentage will be determined by comparing the signals reported active from Have Example to those reported active by the radio frequency (RF) signal environment monitor (RSEM) and range instrumentation data. A ratio of these two quantities will be used to calculate correct signal ID percentage. Signals identified by the Have Example which are not verified by the RSEM or range instrumentation data will be considered as false alarms only if not reasonably expected to exist within the Have Example field of view (FOV).

5.1.1.1 Data Requirements

The following data types will be required for data reduction/analysis:

a. Have Example test data
b. Threat system instrumentation data
c. The RSEM data

5.1.1.2 Algorithms/Processes

The following algorithm will be used to calculate correct signal ID percentage:

$$\text{Correct Signal ID Percentage} = \frac{t_{CorrectHaveExample}}{t_{TotalHaveExample}} \; x \; 100$$

Where:

$t_{CorrectHaveExample}$ = the amount of time the Have Example system correctly identified a specific signal.

Note - Correct signal IDs are the Have Example IDs that match the reference sources IDs.

$t_{TotalHaveExample}$ = the total amount of time the Have Example system identified a specific signal. This time includes false signal IDs.

Note - False signal IDs are the Have Example IDs that do not match the reference sources IDs and are not possible in the Have Example FOV. False signal IDs do not include the Have Example signal IDs that do not match the reference sources IDs, but are possible in the Have Example FOV.

5.1.2 Measure of Performance 2 - Mean Time to ID

Mean time to ID will be determined by measuring the difference in the time a correctly identified signal is displayed on the human-machine interface (HMI) and the time the Have Example system detected the signal.

5.1.2.1 Data Requirements

The following data will be required for data analysis:

a. Have Example test data

b. Threat system instrumentation data

c. The RSEM data

5.1.2.2 Algorithms/Processes

The following algorithm will be used to calculate the Have Example mean time to ID:

$$\text{Mean Time to ID} = \frac{\sum_{i=1}^{n} {}^{t}ID_i - {}^{t}D_i}{n}$$

Where:

t_{ID} = the time that ID of a specific signal occurred.

t_D = the time that the signal was first detected by the Have Example system. This will be verified by RSEM and range instrumentation data to ensure the signal was present.

n = the number of time-to-ID trials for a specific signal.

6.0 DATA ANALYSIS PRODUCTS

The preliminary report of results (PRR) requires the results of all quick-look data (Objective 1 - MOP 2). The technical report requires the results of all indepth analysis data. This includes:

a. Correct signal ID percentage for each signal

b. Mean correct signal ID percentage for all signals

c. Standard deviation correct signal ID percentage for all signals

d. Plot of correct signal ID percentage versus signal type

e. Evaluation (satisfactory, marginal, unsatisfactory) of correct signal ID percentage

f. Mean time to ID for each signal

g. Mean time to ID for all signals

h. Standard deviation of mean time to ID for each signal

i. Standard deviation of mean time to ID for all signals

j. Plot of mean time to ID versus signal type

k. Evaluation (satisfactory, marginal, unsatisfactory) for mean time to ID

7.0 DATA DISTRIBUTION

Table D8 identifies the data distribution. All data will be collected and distributed by the Have Example test manager.

Table D8
DATA DISTRIBUTION

Distribution/Data	Have Example	RSEM	Emitter Instrumentation	Other
Air Combat Command	X	X	N/A	N/A
System Program Office	X	X	N/A	N/A
412 TW/DOC	X	X	X	X
Mary Smith Inc.	X	X	X	X
Lake Muroc AFB	N/A	N/A	X	X

Notes: 1. RSEM - radio frequency signal environment monitor
2. N/A - not applicable

8.0 HARDWARE AND SOFTWARE REQUIREMENTS

To perform data analysis, the standard 412 TW/DOC data analysis workstation (DAWS) system is required. The standard DAWS system consists of a Dell 486 computer operating at 33 MHz with VGA graphics, a 5.25-inch drive, a 3.5-inch drive, a 44-MByte Bernoulli drive, along with the DAWS analysis software. A color laser printer is also needed for sample track plots for the final report.

APPENDIX E

INSTRUMENTATION PLAN

INSTRUMENTATION PLAN

1.0 INTRODUCTION

This appendix describes all of the instrumentation system requirements, the responsibilities, and hook-ups to support the Have Example flight test. Table E1 lists the instrumentation requirements. Table E2 lists the organization responsible for meeting the instrumentation requirements.

Table E1
INSTRUMENTATION REQUIREMENTS

Title	Requirements
Have Example Data Capture	Capture internal Have Example 1553 data messages containing signal detection and ID commands and reports.
Radio Frequency (RF) Environment Validation	Monitor the 500-MHz to 20-GHz RF environment viewed by the Have Example system. Verify the integrity of the SOI and record the signal types and events.
Signal of Interest On/Off Report	Record the threat emitter transmitter on/off events.
Have Example Display Recording	Record the Have Example display on a super video home system (SVHS) videotape compatible with the 412 TW/DOC SVHS tape player Sony model WEW-12345.
Communication Recording	Record communication between the RF signal environment monitor, Have Example, and ground site operators on an audio tape compatible with the 412 TW/DOC audio tape player TECH model FGR-3434.
Platform Position Data	Record test aircraft position and attitude information at a data rate of five times per second.
Universal Coordinated Time (UCT) Tagging	All data collected will be tagged with UCT
Data Formatting	All digital data will be provided to the Have Example test manager on 44-MByte Bernoulli disk or on standard 3.5-inch floppy diskettes recorded in ASCII II format.
Other	Instrumentation to be integrated into the test aircraft will conform to the following items: a. Meet or exceed MIL-STD-XXX, operation and storage at altitudes up to 15,000 feet MLS. b. Overall weight will not exceed 3,500 pounds, and will fit on a standard C-130A aircraft pallet occupying no more than a 8' x 8' x 8' space. c. Total power consumption will be a balanced three-phase load, not to exceed 3000 watts per leg, operating on 115 volts, 60 Hz alternating current.

2.0 INSTRUMENTATION RESPONSIBILITIES

The following section describes the instrumentation responsibilities for each organization in satisfying their allocated instrumentation requirements.

Table E2
INSTRUMENTATION RESPONSIBILITIES

Title	Responsible Organization
Have Example Data Capture	Mary Smith, Inc.
Radio Frequency Environment Validation	412 TW/DOC
Signal of Interest On/Off Report	Lake Muroc AFB Test Range
Have Example Display Recording	412 TW/DOC
Communication Recording	412 TW/DOC
Platform Position Data	412 TW/DOC Lake Muroc AFB Test Range
Universal Coordinated Time Tagging	412 TW/DOC Mary Smith, Inc. Lake Muroc AFB Test Range
Data Formatting	412 TW/DOC Mary Smith, Inc. Lake Muroc AFB Test Range
Other	412 TW/DOC

2.1 Mary Smith, Inc.

Mary Smith, Inc., will be responsible for capturing Have Example 1553 data messages. They will be responsible for providing the embedded test software which will capture signal detection and ID commands and reports. During real-time data collection, this information captured will be tagged with universal coordniated time (UCT) and saved on the Have Example 520-MByte hard drive. At the end of each test period, the Have Example operator will transfer the contents of the hard drive onto a 44-MByte Bernoulli disk in an ASCII II format.

2.2 412 TW/DOC

The 412 TW/DOC is responsible for providing the capability to validate the radio frequency (RF) environment viewed by the Have Example system, to record the Have Example display, and to record the communication between the radio frequency signal environment monitor (RSEM), Have Example, and ground site operators. Each of these capabilities are described in the following sections.

2.2.1 Radio Frequency Environment Validation

The 412 TW/DOC operates and maintains an RSEM that will satisfy the requirements for RF environment validation. The RSEM consists of the equipment listed in Table E3 which also identifies the availability of each item. The RSEM will be integrated into the test aircraft and interfaced with the Have Example system as shown in Figure E1.

The RSEM software is maintained by the 412 TW/DOC and will not require any modification to meet the requirement to verify the RF signal environment viewed by the Have Example system. The RSEM will measure and record SOI frequency and strength in real-time. Data will be stored on the system's internal hard drive. All signal activity is automatically stored by the RSEM in an ASCII II format and annotated with UTC. At the end of each test period, the RSEM operator will transfer data from the hard drive onto a standard 3.5-inch floppy disk in ASCII II format.

Table E3
RADIO FREQUENCY SIGNAL ENVIRONMENT
MONITOR EQUIPMENT LIST

Item	Description	Manufacturer	Model Number	Serial Number	Availability
RFDU	RF Distribution Unit	Mirage Systems	RFD-301A	001	On hand
Spectrum Analyzer	Display	Hewlett-Packard	HP 700041	2016A00151	On hand
	Mainframe	Hewlett-Packard	HP 70001A	2927A02752	On hand
	Narrow Band IF	Hewlett-Packard	HP 70902A	2923A02527	On hand
	Local Oscillator	Hewlett-Packard	HP 70900B	2923A00213	On hand
	RF Section	Hewlett-Packard	HP 70905A	2925A00748	On hand
	Precision Frequency Ref.	Hewlett-Packard	HP 70310A	2922A00904	On hand
	RF Tracking Generator	Hewlett-Packard	HP 70300A	2924A00680	On hand
Computer	CPU	N/a	386DX	455997056	On hand
	Monitor	Sony	CPD-1304	5001921	On hand
	Keyboard	Scottie	EP345XTAT	6312227	On hand
	Trackman Mouse	Logitech	T-CA1-9F	LU119100158	On hand
Printer	OmniLaser Printer	Texas Instruments	T12115	3336470418	On hand
TCG	Time Code Generator	Datum	9150-1543	663	On hand

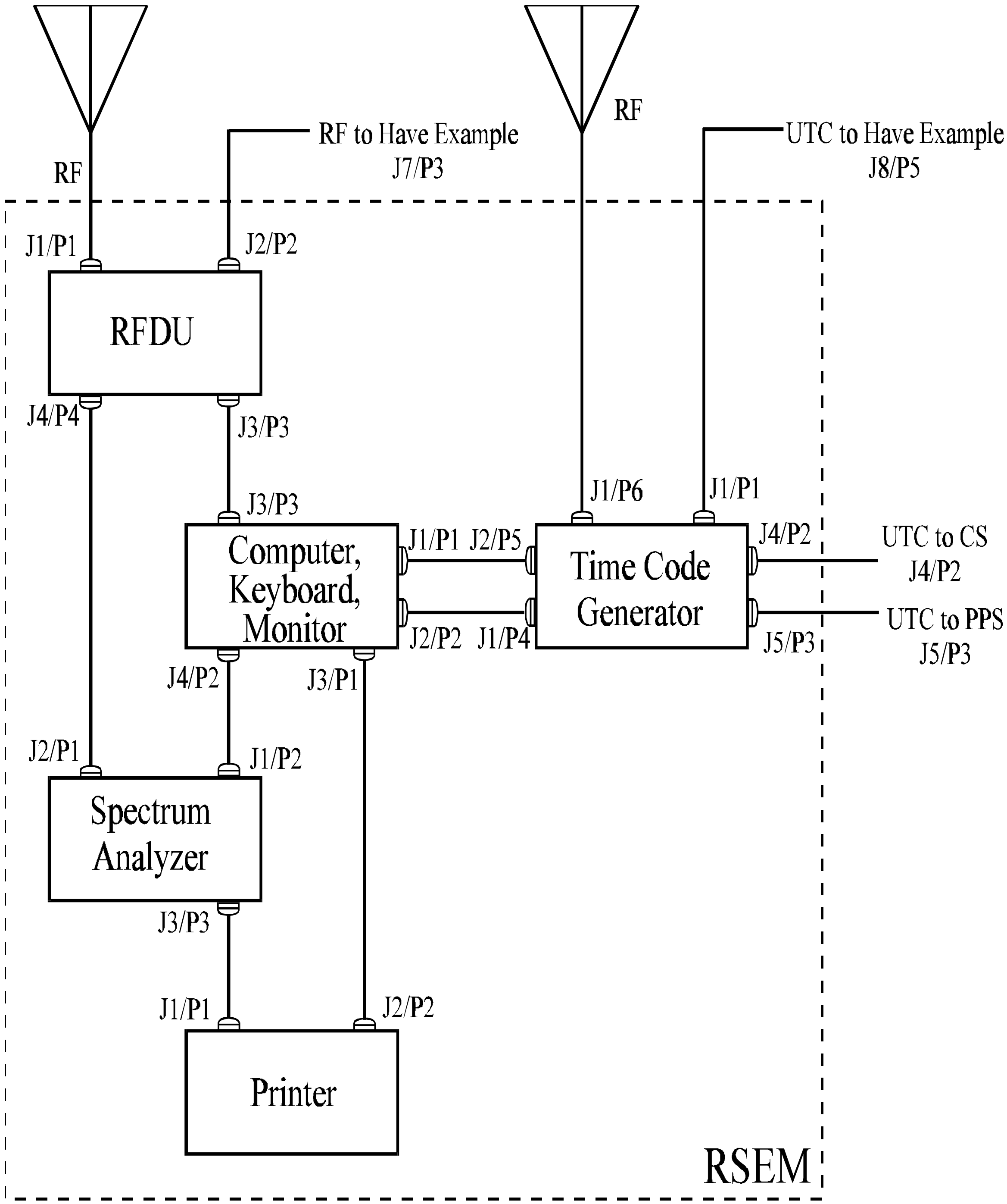


Figure E1 Radio Frequency Signal Environment Monitor Inter/Intra-Connection Diagram

2.2.2 Communication Recording and Platform Position Data

The 412 TW/DOC operates and maintains a test aircraft equipped with a platform positioning system (PPS), communication station (CS), 60/400 Hz alternating current (ac) power, and has the mechanical and electrical connections for installation of the RSEM and the Have Example system (Figures E2 and E3). Platform position and attitude data are recorded with UTC by the PPS. The CS interfaces with the RSEM and Have Example and provides data and voice communication with ground systems. The CS also has the capability to record all communication annotated with UTC. The PPS and CS consist of the equipment listed in Tables E4 and E5. Each table identifies the status of each major item of the system.

Test aircraft position data will be collected from the onboard PPS. Data are stored on a standard 3.5-inch floppy disk in an ASCII II format and annotated with UTC. The CS records voice communication, annotated with UTC, between the ground and airborne system operators. Recorded audio is provided on a standard audio cassette for audio tape player, TECH model FGR-3434.

2.2.3 Have Example Display Recording

The 412 TW/DOC will integrate a scan converter and SVHS video recorder into the test aircraft as shown in Figure E4 to satisfy the requirements for Have Example display recording. Recorded video will be annotated with UTC on standard SVHS video cassettes for SVHS tape player, Sony model WEW12345. The required equipment for this integration is listed in Table F6 which also identifies the availability of each item.

2.3 Lake Muroc AFB Test Range

There are two instrumentation requirements for the Lake Muroc AFB Test Range. These are to provide threat emitter transmitter on/off times and to provide backup platform position data. Each of these instrumentation capabilities exist at Lake Muroc AFB Test Range. No development or modification to the test assets is required. Each of these capabilities are briefly described in the following sections. More indepth descriptions can be found in the Lake Muroc AFB Test Range User's Guide, September 1990.

2.3.1 SOI On/Off Report

The Lake Muroc AFB Test Range operates and maintains threat emitters that will be used for Have Example flight testing. Each emitter is instrumented to report the time the transmitter is activated and deactivated. Transmitter on/off time will be annotated with UTC and be provided on a standard 3.5-inch floppy disk in an ASCII II format.

2.3.2 Platform Position Data

The Lake Muroc AFB Test Range operates and maintains FPS-16 radar trackers. The FPS-16 will provide platform position data recorded with UTC. Recorded data will be provided on a standard 3.5-inch floppy disk in an ASCII II format.

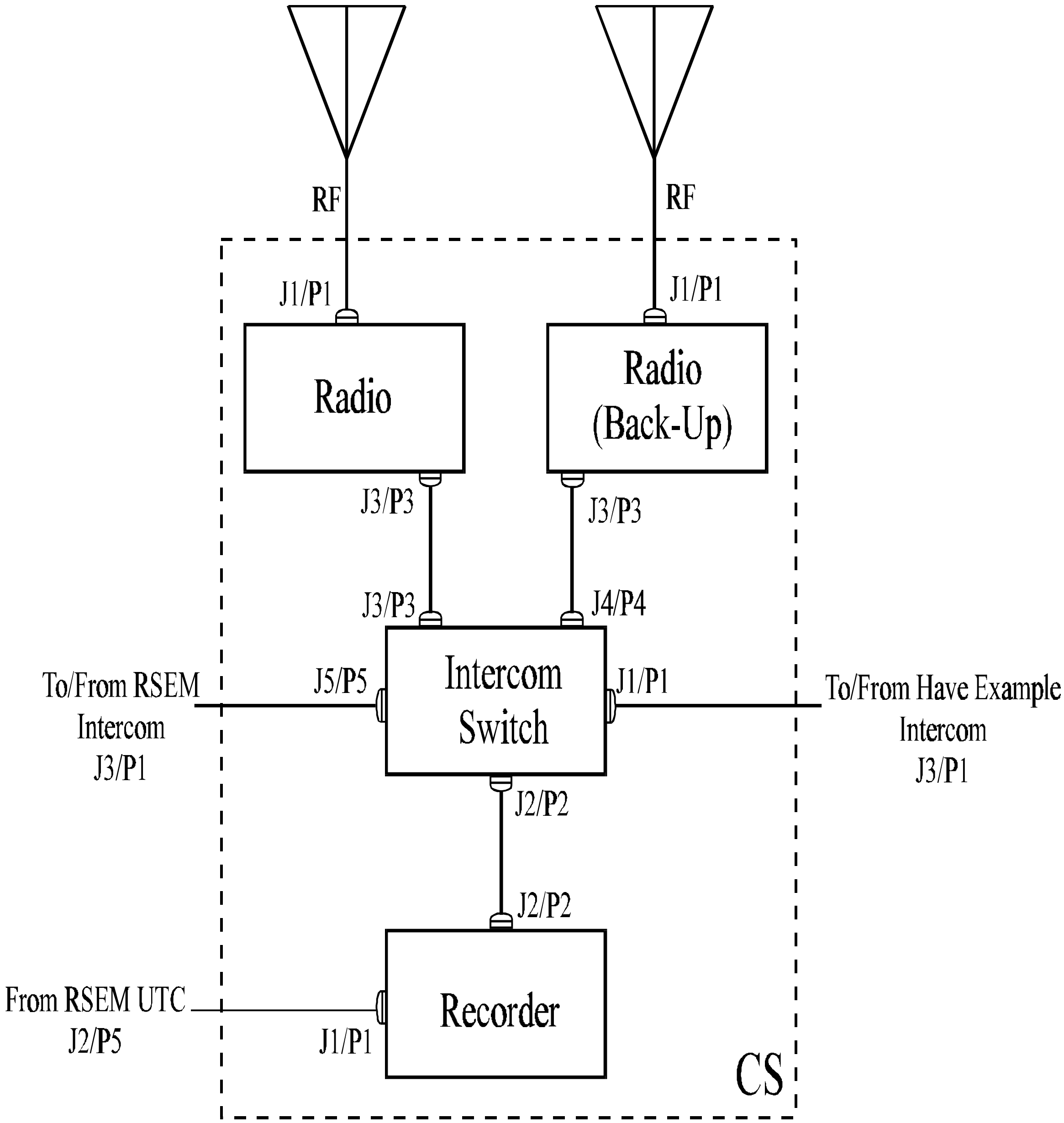


Figure E2 Communication Station Inter/Intra-Connection Diagram

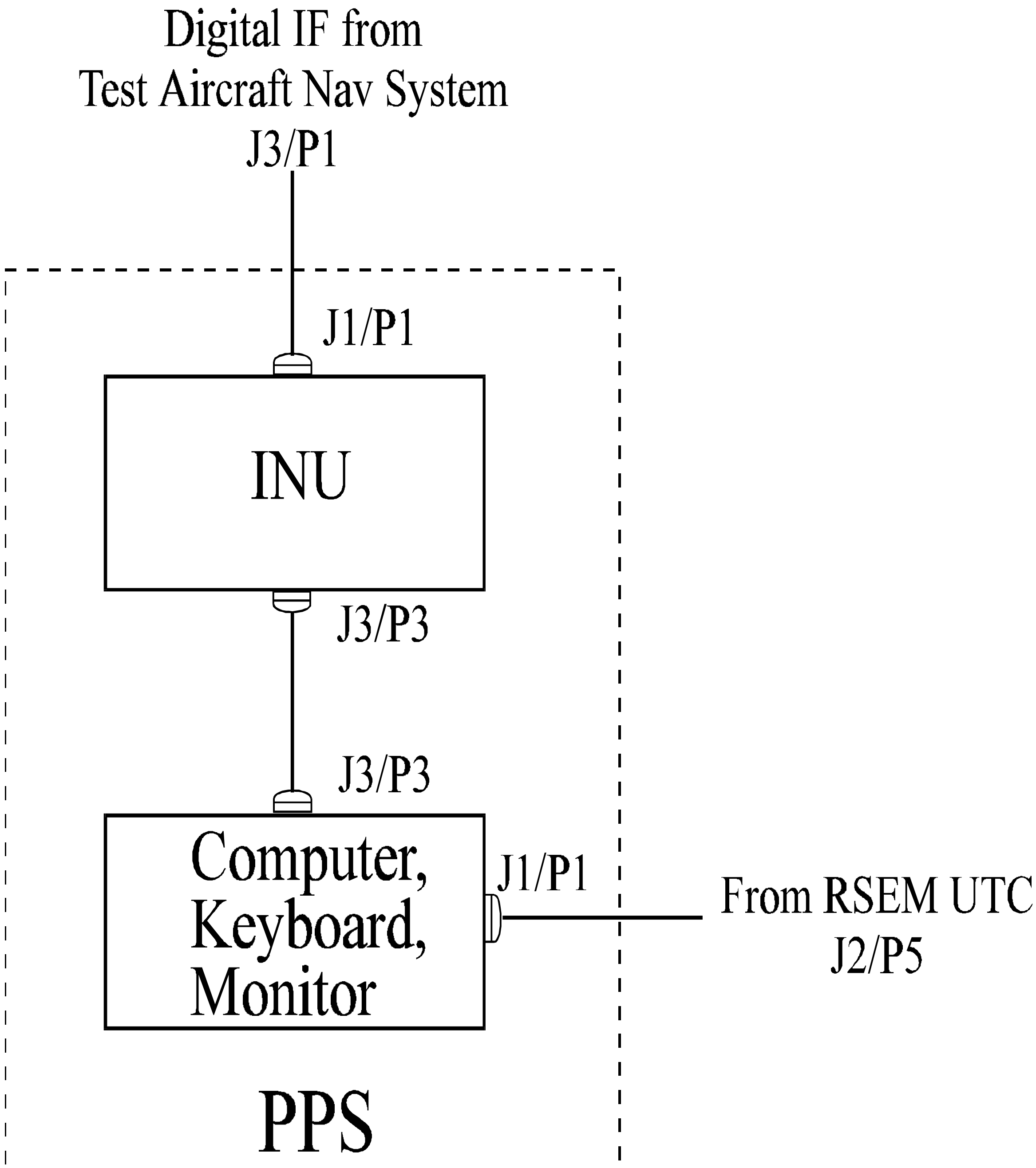


Figure E3 Platform Positioning System Inter/Intra-Connection Diagram

Table E4
PLATFORM POSITIONING SYSTEM
EQUIPMENT LIST

Item	Description	Manufacturer	Model Number	Serial Number	Availability
INU	Inertial Navigation Unit	Honeywell	JCS-Star	1	On hand
Computer	Computer	N/A	386DX	SDR-333	On hand
	Monitor	Sony	CPD-1304	5001388	On hand
	Keyboard	Scottie	EP3417261	2238021	On hand
	Trackman Mouse	Logitech	T-CA1-9F	LU119100159	On hand

Table E5
COMMUNICATION STATION
EQUIPMENT LIST

Item	Description	Manufacturer	Model Number	Serial Number	Availability
Radio	Receiver/Transmitter	Andrea Radio Corp	ARC-164	333-46456	On hand
Radio	Receiver/Transmitter	Andrea Radio Corp	ARC-164	443-35453	On hand
Recorder	Audio Tape Recorder	TECH		146267-54345	On hand
ICOMM Switch	Intercom Switch	ICOMM, Inc.	IOA-15G	227/A/B	On hand

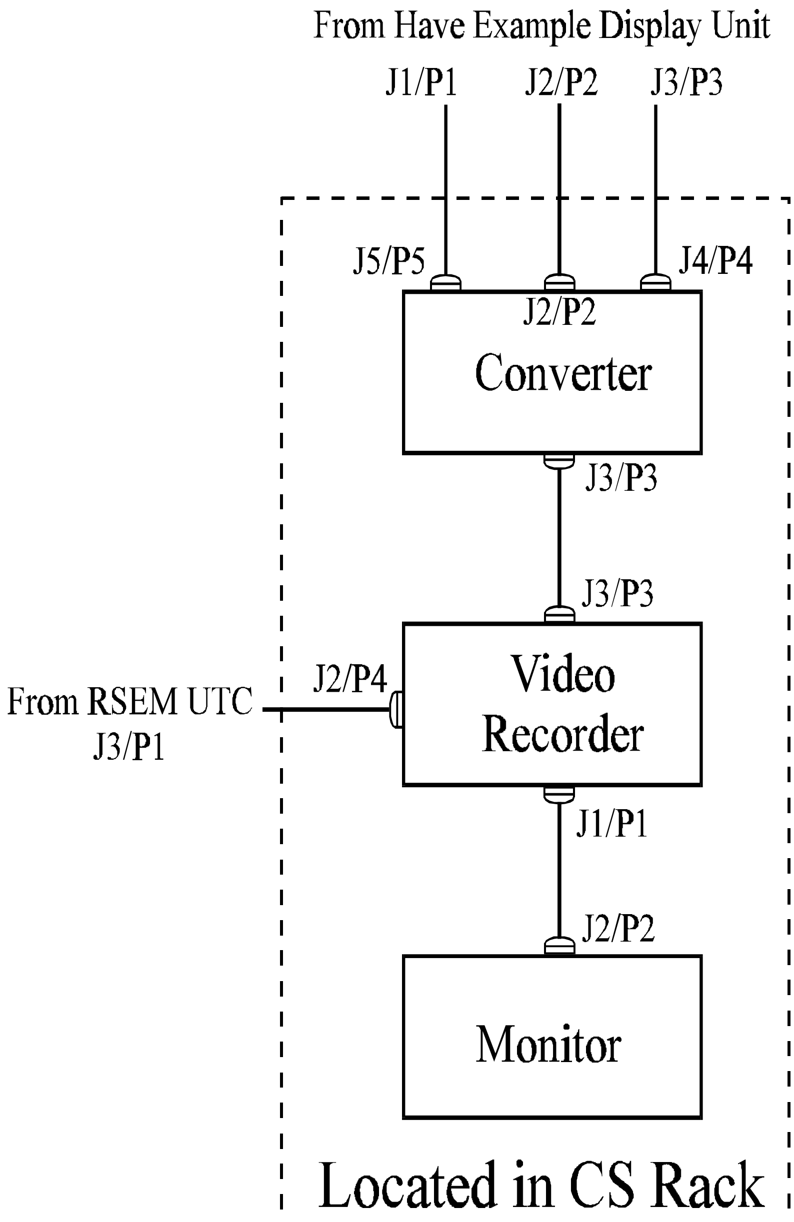


Figure E4 Have Example Display Recorder Inter/Intra-Connection Diagram

Table E6
HAVE EXAMPLE DISPLAY RECORDING EQUIPMENT LIST

Item	Description	Manufacturer	Model No.	Serial No.	Availability
Converter	Scan Converter	RGB Spectrum		RGB-3557-F	On hand
Video Recorder	SVHS VCR	Sony		RSD-2434-D	On hand
Monitor	13" Monitor	Panasonic		344-4423-RDR	On hand

Note: SVHS - super video home system

APPENDIX F

LOGISTICS SUPPORT PLAN

LOGISTICS SUPPORT PLAN

1.0 GENERAL

This Logistics Support Plan identifies the logistics requirements to support the Have Example flight test program. The individuals identified in Table F1 are the points of contact (POCs) for their organization in support of the execution of this logistics plan.

Table F1
POINTS OF CONTACT

Name	Organization	Telephone Number
Curt Russell	412 TW/DOC	(805) 123-4444
Rex "ACE" Reed	System Program Office	(702) 555-8888
Homer Simpson	Air Combat Command	(702) 999-3333
Mary Sue Who	Mary Smith Inc.	(404) 987-6666
Henry Winkler	Lake Muroc AFB	(505) 777-9999

2.0 TRANSPORTATION

Each organization of the test team is responsible for transportation of their personnel to and from Lake Muroc AFB, California, 1 day prior to and after testing. The POCs identified in Table F1 are responsible for coordination of personnel transportation for their organization.

3.0 SHIPPING

All media and materials will be transported by each organization to Lake Muroc AFB 10 days prior to the first day of flight testing. The Have Example, support equipment, and instrumentation will be transported by each organization to Edwards AFB, California, 30 days prior to the first day of flight testing. This equipment will be installed on the C-130A Airborne Avionics Research Testbed (AART). Upon completion of the test program, the equipment will be returned to Edwards AFB, California, via the AART. Each organization will be responsible for reorganizing their equipment after it has been removed from the AART and transporting it back to their point of origin. The POCs identified in Table F1 are responsible for coordination of equipment to be shipped for their organization. The POCs will provide a finalized schedule and an inventory of items to be shipped to the 412 TW/DOC. The inventory list will contain the nomenclature, manufacturer, model number, serial number, weight, size, and whether it is automated data processing equipment or not. This list will be provided to the Have Example test program manager 45 days prior to the first day of flight testing.

4.0 BILLETING

The Air Force Flight Test Center (AFFTC) will make the required billeting arrangements for Government personnel. Contractors will make their own arrangements. Test team personnel will be billeted at the Beverly Hills Hilton (if possible). If billeting is not available, then each organization will make their own billeting arrangements in the local community. The POCs identified in Table F1, will provide a finalized list of personnel to support this effort to the Have Example test program manager 15 days prior to the first day of flight testing.

5.0 CLASSIFIED

The Have Example test manager will be the POC for receiving and shipping classified materials. The AFFTC will provide one 2-drawer safe for storage of classified documents and media in support of this effort. All virgin media will be stored in an unclassified storage area until required. Operations Security (OPSEC) has been considered and will be conducted in accordance with (IAW) AFR 55-30, *Operations Security* (Reference 6).

6.0 MEDIA REQUIREMENTS

Media requirements have been established for data collection based on the following test conditions:

Time/Hours	Comment
0.5	Setup, checkout, and calibration
3.0	Test Time
+ 0.5	Post-test checkout
4.0	Subtotal for one test
+ 2.0	Number of tests
6.0	Subtotal
2.0	Plus 25-percent backup and miscellaneous
10.0	Total estimated media requirements per test resource/system

Table F2 identifies the media requirements by test resource/system based on the requirement for 10 hours of data collection.

Table F2
MEDIA REQUIREMENTS

Organization/ Supplier	Resources	System	Collects	Quantity/Type
Air Force Flight Test Center	Test Aircraft	Platform Positioning System Communication Station Radio Frequency Signal Environment Monitor VCR	Data Recording Comm Recording Data Recording Have Example Display Recording	One spare 520-MByte removable hard drive Ten 1-hour cassettes Twenty 3.5-inch floppy disks Five 2-hour super video home system cassettes
Contractor	Have Example System	Data Storage	Have Example Data Recording	One spare 520-Mbyte removable hard drive Two 44-Mbyte Bernoulli diskettes

7.0 SUPPORT

Lake Muroc AFB will provide sheltering, ground refueling, and general maintenance for the test aircraft. Henry Winkler is the POC for these activities.

Lake Muroc AFB will provide secure work space for all test team personnel. This work space will serve as a data analysis area. In addition, storage space will be provided for project equipment and material. Henry Winkler is also the POC for these activities.

8.0 MAINTENANCE

Each organization will maintain their own equipment. For critical items, spares will be brought with the deployment team. Lake Muroc AFB will provide maintenance for the C-130A aircraft.

9.0 TRAINING

No training requirement will be required for AFFTC personnel. The AFFTC will provide trained personnel for AART and RSEM. The contractor will provide Have Example user training to Government operators 30 days prior to deployment. The test range will provide fully qualified personnel to operate their systems.

10.0 ADMINISTRATION SUPPORT

Each Government organization will issue orders and visit requests for their personnel supporting the flight tests. The System Program Office (SPO) will issue orders for the contractor personnel as required. Final billeting arrangements will be annotated on the orders and a copy delivered to the AFFTC test program manager. Each organization will transmit security clearances to Henry Winkler at Lake Muroc AFB. All personnel should be reminded that picture identification will be required.

11.0 TEST AND SUPPORT PERSONNEL

Table F3 lists test team personnel with responsibilities essential to the implementation of the ground tests. During testing, the test team personnel will not exceed the maximum number that can safely work in the AART. Support personnel will assist in conducting the tests as required.

Table F3
TEST TEAM PERSONNEL

Name	Organization	Function
Curt Russell	412 TW/DOC	Test Director
John Wayne	412 TW/DOC	RSEM Operator
Skippy Smith	412 TW/DOC	CS & PPS Operator
Rex "ACE" Reed	System Program Office	Test Monitor
Bart Simpson	System Program Office	Test Monitor
Jane Russell	Air Combat Command	Have Example Operator
Lisa Simpson	Air Combat Command	Have Example Operator
Homer Simpson	Air Combat Command	Have Example Operator
Mary Sue Who	Mary Smith Inc.	Contractor/Support/Hardware
Cindy Lou Who	Mary Smith Inc.	Contractor Support/Software

Notes: 1. RSEM - radio frequency signal environment monitor
2. CS - communication system
3. PPS - platform positioning system

11.1 Responsible Test Organization Personnel

The AFFTC 412 TW/DOC is the responsible test organization. There will be three personnel supporting the ground tests. The team will consist of a test director/test engineer, a communication station and platform positioning system operator/engineer, and a data analyst/RSEM operator. These personnel will record test activity in log books and operate the AFFTC data acquisition equipment and instrumentation.

11.2 System Program Office/Air Combat Command

Two personnel from the SPO and three from the Air Combat Command will be deployed to support the flight tests. Air Combat Command personnel will operate the Have Example. Personnel from the SPO will be deployed to monitor the test activity.

11.3 Participating Test Organization Personnel

The Lake Muroc AFB test range will ensure that sufficient personnel are available to operate all necessary test range assets.

11.4 Contractor Personnel

There will be two personnel deployed to support the ground tests. The team will consist of a hardware engineer and a software programmer. These personnel will setup and check out the Have Example system and equipment. Afterwards, they will provide support as required.

12.0 SUPPLIES

Each organization must provide their own office supplies, media, etc.

13.0 SCHEDULE

Testing is scheduled from 13 to 17 April 1992. There will be a minimum of two 3-hour tests conducted in this time period. Figure 7 reflects the activities that are to be implemented to execute this plan.

LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS

Abbreviation	Definition	Units
AART	airborne avionics research testbed	---
AFB	Air Force Base	---
AFFTC	Air Force Flight Test Center	---
AFR	Air Force Regulation	---
Alt	Altitude	---
ac	alternating current	---
COMSEC	communications security	---
CS	communication station	---
DAP	data analysis plan	---
DAWS	data analysis workstation	---
DR	deficiency report	---
deg	degree(s)	---
EW	early warning	---
FOV	field of view	---
FS	fuselage station	---
ft	feet/foot	---
GHz	gigahertz	---
HMI	human-machine interface	---
Hz	hertz	---
IAW	in accordance with	---
ID	identification	---
IRIG-B	Inter-Range Instrumentation Group-B	---
kt	knots	---
MHz	megahertz	---
MNS	mission needs statement	---
MOP	measure of performance	---
N/A	not applicable	---
OBJ	objective	---
OPSEC	Operations Security	---
ORD	operational requirement document	---
PID	program introduction document	---
POC	point of contact	---
PPS	platform positioning system	---

LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Concluded)

Abbreviation	Definition	Units
PRR	preliminary report of results	---
RF	radio frequency	Hz
RSEM	radio frequency signal environment monitor	---
RTO	responsible test organization	---
RWR	radar warning receiver	---
SD	signal detect	---
SI	signal identify	---
SOI	signal of interest	---
SPO	System Program Office	---
SUT	system under test	---
SVHS	super video home system	---
spd	Speed	---
std	standard	---
TBD	to be determined	---
TC	test conductor	---
TD	test director	---
TEMP	test and evaluation master plan	---
TIS	Test Information Sheet	---
TSPI	time space position information	---
UCT	universal coordinated time	---
UHF	ultra-high frequency	Hz
VCR	video cassette recorder	---
VHS	video home system	---
XON	transmitter on	---

DISTRIBUTION LIST

The following identifies the distribution of Have Example technical reports. All reports will be distributed by the 412 TW/DOC.

	No. of Copies			
Offsite Distribution	Test Plan	Preliminary Report of Results	Technical Letter Report	Service Report
Air Combat Command John Wayne Plaza 2 Washington DC 29351-5460	1	1	1	1
System Program Office Building 1033, LBJ Complex Wright-Patterson AFB OH 45433-5554	1	1	1	1
Mary Smith, Inc. 327 Alisel Ct. Milpitas CA 94040-1256 Attn: Mary Sue Who	1	1	1	1
Onsite Distribution	1	1	1	1
412 TW/DOC	7	7	7	7
Total	11	11	11	11

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TEST PLAN PREPARATION GUIDE RECOMMENDED CHANGE FORM

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Typed Name and Grade of Originator	Signature